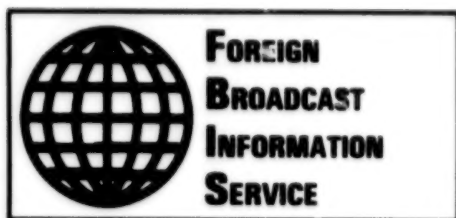


JPRS-EST-94-003  
26 January 1994



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# ***JPRS Report***

# **Science & Technology**

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***Europe/International***

# Science & Technology

## Europe/International

JPRS-EST-94-003

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## COMPUTERS

### European Affairs: JESSI Program Produces Marketable CAD Systems

BR0612151293 Paris *ELECTRONIQUE INTERNATIONAL* HEBDO in French 2 Dec 93 p 13

[Article signed S.D.: "Computer-Aided Design: JESSI Program Produces Tangible Results"]

[Text] Many computer-aided design (CAD) tools developed within the scope of the Joint European Submicron Silicon Initiative (JESSI) are already being commercialized, mostly by European companies.

During the presentation of JESSI's mid-term results at the "Componic" fair, J.-P. Tual (Bull) provided a status report of the electronic CAD subprogram. "All targets have been met," he concluded, stressing that JESSI-developed CAD tools "have reached industrial quality and are actually being commercialized."

The CAD subprogram has four major goals: To develop CAD tools for specific applications which meet industry's requirements and for which no commercial systems are available; to foster the development of a European CAD industry by strengthening the (scarce) existing potential and by developing new market segments; to supply methods and tools for libraries development and modeling; and to promote the use of standards (VHDL [very-high-speed hardware description language], EDIF [Electronic Data Interchange Format], Frameworks) and European participation in standards development. The CAD subprogram operates according to the following major principles: no exotic tools, but tools that are compatible with commercially available ones; libraries that can be used for the development of various CAD systems; and the effective dissemination of tools developed under the program. With this, Tual emphasized, European manufacturers seek to counter "the U.S. tools syndrome, according to which only the Americans produce good tools."

#### Some 20 'Major' Tools Already on the Market

Further expanding on the results to date, Tual mentioned CAD tools developed for specific telecommunications applications, some of which are being commercialized by the companies Racal-Redac (card design tools) and by Anacad (mixed analog-digital design tools). In the area of automotive applications, he mentioned the commercialization of retiming tools by Philips and of a synthesis tool for field-programmable gate arrays (FPGA) by the Grenoble company Innovative Synthesis Technologies. Various JESSI-developed tools are also being marketed by other companies, including SNI [Siemens Nixdorf] and the French Aster Ingenierie [Aster Engineering] company, which is offering a testing tool obtained through a technology transfer from Bull. Another Bull technology (a formal testing tool) is being marketed via a partnership with the U.S. company

Compass. Mentor/EDC, another U.S. company, is marketing a DSP (digital signal processor) developed under JESSI. Tual stressed that the industrialization and commercialization of JESSI-developed CAD tools is expected to gain even more momentum during the second half of the program, which will be completed in late 1996.

### European Affairs: Three European Customers For Cray Supercomputers

BR1412123993 Edam *SUPERCOMPUTER EUROPEAN WATCH* in English Oct 93 pp 10-12

[Unattributed article: "Three European Orders For Cray's MPP"]

[Excerpts] After a slow (or late) start Cray Research entered the massively parallel processing [MPP] area with its T3D system. According to Cray officials, the T3D must lead the company to MPP market leadership within one year. First orders include Switzerland, France and the United Kingdom. [passage omitted, describing Cray T3D features.]

#### Performance

On some tests, the 128-processor T3D system was as much as four times faster than all other MPP products with up to 128 processors, Steve Nelson, head of Cray's T3D development program said; and continued that in these tests, and in operation at Pittsburgh Supercomputing Center (PSC), the Cray T3D system demonstrated latency of under one microsecond. Latency—the time it takes for a processor to begin using data it has requested—is key to overall MPP system performance and ease-of-programming. "current leading MPP vendors are in the 100-microsecond latency range, and are targeting the tens-of-microseconds range in the next two years," Nelson said. "For this key performance indicator, the Cray T3D system is typically two orders-of-magnitude ahead of current leading MPP products."

#### Installations

PSC has installed and accepted a 32-processor T3D prototype scheduled to grow in early 1994 to a 512-processor production system. Other early customers are NASA's Jet Propulsion Laboratory and the Swiss Federal Institute of Technology EPFL (Ecole Polytechnique Federale de Lausanne) which has signed a preliminary agreement to acquire a 256-processor system in early 1994. These three customers will collaborate under Cray's Parallel Applications Technology Program (PATP), to develop targeted software applications for the T3D system.

Further European customers are the European Centre for Medium-Range Weather Forecasts (ECMWF) and the French Atomic Energy Commission, Commissariat a L'Energie Atomique (CEA).



ECMWF ordered a Cray T3D MCA64-8, a 64-processor, air-cooled system. The T3D will be closely coupled with a Cray Y-MP2E system also ordered by ECMWF. Both systems are scheduled to be installed at the Centre's Reading, England, headquarters in mid-1994. ECMWF will use the T3D to develop new forecasting models that take advantage of MPP technology, and also to run the Centre's ensemble prediction package, used to generate forecasts provided to 18 national weather services throughout Europe. In Ensemble forecasting, meteorologists run multiple versions of a forecasting model, varying the data describing the initial weather conditions with each run. This computation-intensive technique is used to improve the accuracy of forecasts by determining their sensitivity to variations in initial weather conditions.

The CEA Division des Applications Militaires [Military Applications Division] ordered a Cray T3D MC128-2, a 128-processor system that will be coupled with a Cray M92 system that is already on site. The system is scheduled to be installed in the fourth quarter of 1993 at CEA's Centre d'Etudes de Limeil-Valenton [Limeil-Valenton Study Center], near Paris. The French will use the T3D for research in fundamental and laser physics, and for electrodynamic and aerodynamic studies.

#### **France: Eye-Controlled Keyboard Developed**

BR0601153494 Paris SCIENCES ET AVENIR  
in French Jan 94 p 9

[Unattributed article: "Writing With the Eyes"]

[Text] "I am pleased to have a new house." Lucie is a tetraplegic child, incapable of correct speech, but she was able to "type" this sentence on a computer in just a few seconds—simply by looking at it. This moving demonstration is the fruit of the work of Jacques Charlier, an optical engineer and researcher at the National Health and Medical Research Institute (INSERM) in Lille, on an eye-controlled system. The device, which can be adapted for use with any microcomputer, includes a sensor that measures line of sight and an assignment table containing the alphabet and a few word processing function symbols. The sensor, placed behind the assignment table, scans eye movement through a central orifice. A method for processing the eye image, based on an identification of specific pupil shapes and the corneal reflection, makes it possible to overcome artefacts such as parasitic reflections. Charlier explains: "Data can be entered at the rate of one to two characters per second. The control principle is not specific to computers—household appliances can also be controlled in this way." This system, with the backing of the Delta 7 humanitarian society, should benefit several hundreds or even thousands of severely handicapped people in France. Unfortunately, the system—costing around 100,000 French francs—will not go on sale for another two to three years, giving home reeducation centers time to evaluate and perfect the system.

#### **Germany: Bayer To Order Cray Computer System**

BR2001151094 Edam SUPERCOMPUTER  
EUROPEAN WATCH in English Nov 93 p 13

[Unattributed article: "Bayer To Order Cray C92"]

[Text] In contrast to United States chemical companies, European chemical/pharmaceutical firms do not buy or use very much high-end computing equipment. For a long time, the German company Schering was the only one with a Siemens/Fujitsu machine in its Berlin Lab. Now Bayer AG (also German) has ordered a computer from Cray Research. A two-processor, air-cooled Cray C92A system featuring very large DRAM memory capacity is scheduled to be installed in first-quarter 1994 in Bayer's Central Research Facility in Leverkusen, Germany. Terms were not disclosed.

Bayer is global player in the chemical industry. In Germany they are producing at five different sites, but they are also producing in Japan, they have a big affiliated company in the United States of America, and they will invest more than ECU150 million in China. Bayer plans to use the new system to solve large, computationally intensive problems in process simulation—such as planning and laying out of production facilities—and to optimise plant operations for safety, environmental factors and cost-effectiveness.

Virtually all supercomputer producers were competing for the business and Bayer's decision followed extensive benchmark testing, said Wolfram Wagner, director of technology resources in the Central Research Facility. These test runs showed that by simulating complex processes, Bayer would be able to reduce costs and time in process development and gain a clear competitive advantage, by optimising plant operations worldwide.

"The Cray system, in conjunction with high-performance software, will open a new dimension in process development for us," he said. "Process simulation means designing the production facility on the computer system, optimising it dynamically, and speeding up its operations. It seems that we can reduce the production costs with more than 10 percent."

Bayer and Cray Research also have agreed to collaborate extensively on developing and optimising computer-aided steady state and dynamic plant simulation. The focal points of the collaboration are:

- Analysis and performance optimisation of plant simulation software;
- Optimisation of application software, through the introduction and testing of specialised software tools;
- Development and testing of new computer-aided methods for simulating complex chemical plants on the T3D, Cray's parallel system;

—Porting and optimisation of applications software on multiprocessor systems, in collaboration with Cray Research and established software vendors;

—Testing of parallel computers for the use of this application software on real production problems.

### Two Cray Sparc Superservers to Europe

BR2001095894 *Edam SUPERCOMPUTER*  
*EUROPEAN WATCH in English Nov 93 pp 3-4*

[Unattributed article: "Two Cray Sparc Superservers for Europe"]

[Text] Cray Research Superservers announced a new superserver product line. The new CS6400 systems are available with four to 64 Sparc processors and have a United States list price beginning at under ECU350,000. In Europe, two sales have already been announced.

In Europe, there are already two announced sales. The research division of Electricite de France (EDF), the world's largest electrical utility, based in Clamart, will be an early customer. A 16-processor system with two Gbytes of central memory will be shipped during November and the system will be upgraded to 32 processors and four Gbytes of memory in 1994. Terms were not disclosed.

EDF, a long-time Cray Research customer, has plans to use the CS6400 for scientific, engineering and data management applications serving users of EDF's extensive computer network.

"We will use the Cray Superserver 6400 system to provide enterprise level general computing services to various organisations within EDF," said Michel Pavard, head of EDF's data processing and applied mathematics unit. "We were looking for a high-performance Unix server to support a variety of applications and a large number of users, and the Cray Superserver 6400 system was our choice. With its data centre capabilities, scalability and excellent price/performance the system fits nicely into our existing network."

The German electronics firm SICAN has also ordered a CS6400 system.

The German electronics firm SICAN, based in Hannover, has also ordered, and is scheduled to receive, a CS6400 system in the first quarter of 1994. SICAN will initially receive a 20-processor system that will be upgraded later in 1994 to a 48-processor system. Again, terms were not disclosed.

SICAN provides design services for German and United States based industries that use Applications Specific Integrate Circuits (ASICs) and full custom designs. The CS6400 system will be used for highly scalar Electronic Computer-Aided Design (ECAD) applications, as well as for data management.

"We are targeting the CS6400 for a number of electronic design codes including commercially available programs and those we've developed in-house," said Hans Weinerth, chairman and CEO for SICAN. "The CS6400 is an outstanding option for us since most of our codes now run on our more than 50 Sun systems. We know that these same codes will run without recompilation on the CS6400, which will provide a central, powerful and cost-effective resource for our many desktop Sun users. In effect, the CS6400 allows us to upgrade each of our workstations with one single purchase."

### Germany : Neural Information System Developed for Different Applications

94WS0098b *Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 28 Oct 93 p 8*

[Article by Arnold Noeldechen: "Research Priorities: GMD Wants to Push Neural Information Development in the Federal Republic—Nanoelectronics is Also Moving Ahead—Light Pulses Control a Transistor Made of Organic Molecules"]

[Text] Neural information science plays an important role in Germany for the development of new image evaluation systems including medicine and robot systems. Neural information science will also become important for future telecommunication systems, as Dr. Christoph von der Malsburg (Ruhr-University Bochum) pointed out at a seminar of the Society for Mathematics and Data Processing (GMD) at Birlinghoven Castle (53757 Sankt Augustin).

According to Professor von der Malsburg, the development of neural information science constitutes a switch from Boolean logic to an "algorithmic world" to control self-organizing systems. Neural information science tries to use the brain's data processing functions for technical communication processes—a field which GMD wants to emphasize in the future.

An interesting practical application is an image processing system which is able to recognize persons on photos, even when the photos have been disguised or when they were taken under different illumination or viewing angles. For recognition, such a photo is covered with a coarse grid and the image content of each grid cell is defined by an algorithm.

The system is based on a mathematical formula which describes how small, spatially arranged waves are changed by a perpendicular sine wave. This allows the mathematical determination of the image content of all grid cells.

Pictures which were distorted by rotation or other means can be quickly compared with the original photo using the distorted grid and the previously defined image content, so that the identity can be established even from distorted pictures. The system can be used for checking personal identities and signatures.

However, it is also suitable for highly automated measuring systems to avoid rear-end collisions. With this system, robots can "recognize" and sort out individual parts, even if they are scattered around randomly. Another possible application is the automatic sorting of waste which would be very beneficial from an ecological point of view since manual sorting does not make sense because of the high labor cost and slow sorting speed.

In addition to neural information science, GMD is pushing ahead with numerous research projects for the integration of computer hardware to avoid falling behind the United States or Japan on an international level. Dr. Gerhard Abstreiter, a professor at the Walter-Schottky-Institute of the Technical University Munich, claims that continued development of microelectronics towards "nanoelectronics" with its even finer structures will not be restricted by physical and technical limitations in the next 20 years.

He says that the necessary manufacturing techniques will not require a completely new technology, but can be accomplished with advanced processes which are already being used today. They are sufficient for layer thicknesses around five Angstrom and for producing structures around 60 nanometers.

Such ultra large-scale (ULSI) circuits would have to take into account quantum-mechanical effects. Research of his institute in this field has already resulted in novel quantum devices, and it is possible to produce n-type transistors for functional logic circuits in the nanometer range.

According to Dr. Manfred Pilkuhn (Physical Institute of the University Stuttgart) the continued integration beyond the nanometer range towards the molecule and atom range will require the use of biological reactions in order to implement molecular circuits measuring only a few nanometers. This includes, for instance, the principle underlying photosynthesis, i.e. the controlled transfer of a charge under light.

The physicists in Stuttgart have presented a molecular transistor which consists only of organic molecules and where the transfer of the charge can be controlled by light pulses. A combination of fulgides called a switching molecule can "block" the transfer of a charge using ultraviolet light. The transfer is made possible again by light in the visible spectrum. Naphtacyanines in a polyethylene matrix receive and store the transmitted charge. This molecular switch was supported and developed in Stuttgart as part of special research program 329.

With the minute size of these structures around ten nanometers, such switch structures can also be used as data storage for binary information with the potential for memory densities similar to those of the human brain.

As Professor Pilkuhn's experiments have shown, the required printed circuits in the molecular range can be

produced quite easily using long molecular chains consisting of polythiophenes, for instance. Since the photolithographic process cannot be used in the molecular range, the researchers will attempt to replace it with application techniques using the Langmuir-Blodgett process. However, Pilkuhn admits that it is not easy to build up the desired structures in this manner.

Another unresolved problem is the attachment of molecular circuits to circuits using nano- or microelectronics. Pilkuhn thinks it is possible to work with optical controls using semiconductor lasers instead of the conventional electrical connections. Experiments in this area are underway at the University of Stuttgart.

One can only hope that the GND will have more success with its research projects in neural information science and advanced electronics than with the development of parallel computers. Some observers think that the Suprenum project could have given German industry a considerable edge if they had succeeded to develop the related software in time. However, the public should also be informed about the economic success, the so-called spin-off, so that the general public understands that research in Germany pays off.

According to the Federal Ministry for Research, GMD's head organization, this year DM1.5 billion will be available for research in information science with DM 1.04 million coming from the budget of the Federal Ministry for Research. Private industry, however, finances about 95 percent of the research itself and thus manages almost completely without government support. On the other hand, the Federal Ministry for Research supports nearly all research institutions, universities, and research associations employing about 3,000 scientists.

#### **Experts Concerned About Data Theft, Computer Security**

*94WS0091A Duesseldorf VDI NACHRICHTEN  
in German No 42, 29 Oct 93 p 21*

[Article by Jens D. Billerbeck: "The Danger of Data Theft"]

[Text]

#### **Systems Forum: What is the Data Security Situation in Germany?**

##### **Experts Criticize a Lack of Awareness of the Problem.**

In Germany, there is a lack of awareness of the problem of data security. This was the conclusion of a panel discussion on the occasion of the Systems Computer Fair in Munich. The group of experts were unanimous primarily in saying that there cannot be complete security against data theft.

The title of the panel discussion on the occasion of the Systems Fair was chosen to be provocative: "The absolute worst-case scenario caused by data theft." The discussion lasted about one hour. However, there was



quick evidence that the problem of data security in German government offices and companies cannot be given high enough importance. This is because our entire society is dependent to a large extent on the availability of advanced information technology. That is precisely the problem, said Prof. Klaus Brunnstein from the University of Hamburg. "We need this technology but it cannot be made 100 percent secure."

With the increasing complexity of data processing solutions and the trend toward variegated services, the effects of breakdowns in the technology become more and more painful. This involves not only the theft of important data but also simple breakdowns of hardware and software. According to Brunnstein, "Hardware errors make up a greater percentage of the problems in EDP than we generally believe." The famous viruses account for a maximum of 25% of such problems.

Regarding data theft, the scientist from Hamburg sees the greatest risk potential in system administrators. These are the individuals responsible for managing EDP systems in companies and government offices. In their role as experts, the systems administrators are usually only poorly monitored and could thus easily access all important data.

Peter Schikora is the director of the FastComtec company. He sees the absolute worst-case scenario for information technology happening in the near future. He cites reports which see the Telekom division of the Federal Post Office suffering damages to the extent of 20 million Deutsche marks per week through the manipulations of hackers. In industry, data on research and development projects worth millions are passed back and forth over virtually unsecured data lines while appropriate security measures would only cost about 150,000 Deutsche marks. "However, data protection is obviously too expensive," according to Schikora, "primarily because the original copy of the stolen data is still available even after the theft."

To tackle the problem, management also needs to be sensitized. Prof. Alfred Bullesbach is the data protection officer at Debis, a subsidiary of Daimler Benz. He says, "Data protection is a management task." In the final analysis, if the available information technology is to be used, the appropriate awareness for the dangers and strategies to defend against these dangers must be developed.

The virus expert from Hamburg, Brunnstein, also sees a considerable lack of information on the part of the police and the criminal prosecution authorities. Very few policemen, judges, or prosecutors are capable of properly evaluating and classifying criminal offenses in conjunction with EDP systems. Appropriate training is urgently needed in this area.

Brunnstein also sees another problem. "Our companies invest about two to five percent of their DP budgets in data security. However, this investment is usually directed toward the central computer and only rarely

toward the PC networks in the company." However, it is precisely these networks that face the greatest danger.

Brunnstein classifies computers into three categories. The first category is "inflexible but secure." These are computers that, for example, also permit monitoring of the administrator and therefore provide a high degree of security. The second category is flexible but not secure. In Brunnstein's opinion, this category includes all PCs running under the operating systems MS-DOS ("Not an operating system, but free housekeeping software," says Brunnstein.), Mac-OS and Unix. Brunnstein puts the newer systems of Windows NT, OS/2 and the most recent network systems into a third category. These systems have good approaches to security but they have not been proven in actual practice.

#### **Germany: Computer Program to Assist in Oil, Gas Exploration**

94WS0098a Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 27 Oct 93 p 8

[Unattributed Article: "Computer Program to Assist in Oil, Gas Exploration—Process in Berlin Evaluates Gravity Field and Magnetic Field Interferences"]

[Text] The search for crude oil and natural gas deposits is primarily based on seismic measurements which is a rather costly process. However, another possibility is the evaluation of gravimetric and magnetic fields which supposedly can be measured quickly and inexpensively. Now, a software system called Igmas which was developed at the Free University of Berl in (Dr. Hans-Juergen Goetze, Institut fuer Geologie, Malteserstr. 74-100, 12249 Berlin) allows the three-dimensional interactive evaluation of these measurements.

As Professor Goetze explains, the gravity and magnetic fields are changed by anomalies in the geological structure. Identification of these anomalies using high-resolution measuring instruments is relatively quick and simple so that these anomalies can be used for the exploration of deposits. However, complex calculations are required to relate the local geological formations to the measured anomalies.

These types of calculations require an enormous amount of computing time. Therefore, it was not possible until now to obtain a clear picture of the geological conditions based on the anomalies of the local gravity or magnetic fields. So far, such evaluations were used only to confirm the results of seismic methods.

According to Goetz, Igmas is able to provide a much more detailed evaluation of the anomalies measurements. Basically, the program uses the representation of geological structures as three-dimensional polyhedrons of any shape. The user models the geological structures until the calculated anomalies agree with the measured values.

As Goetze reports, the result is then illustrated on the screen which greatly facilitates the search for a potential deposit site. Igmas can also be used for the interpretation of gravimetric well hole measurements.

The program has interfaces to connect to conventional seismic evaluation programs and therefore allows a complex interpretation of the measured values. Igmas can also be used for environmental purposes such as waste dump and cavity studies.

#### **Bull Develops Malfunction Analysis Software**

94WS0108A Paris *L'USINE NOUVELLE* in French  
16 Sep 93 p 59

[Article by Thierry Lucas: "A Technological Bound in Malfunction Analysis"; *L'USINE NOUVELLE* introduction is "A new, more powerful program to better pinpoint the combined causes of breakdowns"]

[Text] What do an automobile, an airplane, a chemical factory, and a satellite have in common? The answer: All of them are complex, multicomponent systems whose reliability engineers must be able to gauge from the moment of their design. To carry out these calculations, manufacturers have been using "malfunction tree" analysis software for many years. Now, a wholly new technique developed by Bull researchers makes it possible to boost the complexity of systems analyzed in this way by a factor of 100 or 1,000! The new technology has been incorporated into Metaprime, a malfunction-tree-analysis software program marketed by Simulog. Metaprime is offered on Unix stations, in conjunction with the program Open Modline, which supplies the graphics tools for modeling and interpreting the results.

The method's basic analytical principle has not changed: Starting with their knowledge of the system's architecture (a car is composed of an engine, a gearbox, steering, etc.), engineers systematically deduce all the combinations of causes that could trigger a breakdown. The major undesirable event (plane crash, environmental accident in a chemical plant, and so on) can be broken down in this way into basic events such as the failure of an electrical circuit, the malfunctioning of a valve, etc. The various elements are represented in a tree graph that shows the link between each malfunction and its causes and consequences. "Qualitative analysis of the malfunction tree can already identify the combination of causes that suffice to create a failure," explains Duc Duong, Simulog's technical director. "But to go farther, engineers must assign a probability value to each basic event and calculate the system's resultant overall reliability. Metaprime is especially good at this quantitative analysis of malfunction trees." Indeed, once a tree has grown to several hundred "branches", the systematic calculation of probabilities quickly eats up prohibitive amounts of computer processing time. What makes Bull's method, which employs a complete set of new algorithms, superior is its ability to manipulate data in a comprehensive way, without causing an explosion in

combinations. As a result, engineers will be able to rigorously analyze the reliability of the most complex systems, without resorting to always-tricky approximations.

#### **France: ACRI to Market Own Supercomputer in 1996**

94WS0060A Munich *COMPUTERWOCHE* in German  
15 Oct 93 p 92

[Article by Lorenz Winter: "ACRI Plans to Market Own First Supercomputer Model in 1996"; Subheadline: "Former Bull Director Stern Is Company's Owner"]

[Text] Paris—By mid-1995, the Advanced Computer Research International [ACRI] firm, headquartered in Lyon, intends to unveil the initial prototype of the supercomputer it will have developed. When Jaques Stern first announced his objective in 1989, it was pretty risky business wanting to be on a par with companies like Cray, NEC, Hitachi or IBM.

Because of some skillful maneuvering by ACRI's founder, however, the project finally won credibility in recent months. In early 1993, for instance, DEC, Bull, France Telecom, energy supplier EDF, the holding industry of France's atomic energy commission and two banks invested FF40 million (approximately DM13 million) in Stern's company. Company spokeswoman, Anne Schroeder believes: "That will help us to narrow the gap with other European developers like Meiko in England, Parsytec in Germany or even Archipel and Telmat in France, and even to outstrip some of them before too long."

#### **Cray Minority Participation Conceivable**

In the February operation, none of the partners was supposed to have acquired more than seven percent in ACRI. A second capital increase is supposed to follow this autumn. According to Stern, it will be "broader and more international in scope" than the first one. That would make ACRI more extensively secure financially, but its owner will then have to forgo his present capital majority.

Fifty percent of the firm's initial capital came from Stern SA trust assets, 25 percent took the form of a French government loan and the remaining 25 percent came from the European Community's [EC] Esprit program.

Shortly after the initial injection of capital, Stern came to an agreement with DEC, whereby, except for a processor it developed on its own, ACRI will also use the U.S. Alpha-Reduced Instruction Set Computer [RISC] Central Processing Unit [CPU] and its UNIX version for its computers.

#### **Sales Offices Planned for U.S. and Europe**

In April '93, when there was an additional technology partnership with Cray. Under its terms, the French and Americans established the Acset company in Belgium to develop a common compiler for both companies' equipment. Nearly 20 of ACRI's and Cray's engineers and



technicians are also supposed to be cooperating via Acset on the portability and optimization of applications programs. According to Stern, subsequent minority participation by Cray in ACRI is "not inconceivable."

ACRI currently employs a total of 160 employees. Even before yearend, the number of jobs is supposed to climb to 200. The company is already scouting out new spaces downtown, in preparation for production of the initial small series run. Company spokeswoman Schroeder opines that, after the 1995 prototypes, a final entry-level model and a range of modular-construction computers can be expected.

Initially, about 10 preliminary installations are planned among a number of preferred customers in French and European industry. Supercomputers are used in the petroleum sector and the auto industry for modeling of products and processes. Stern believes that now, biochemistry, pharmaceuticals, banking and insurance are also appropriate users. In industry, mainframes are mostly obsolescent. Yet, the penetration of scientific methods in corporate management is rapidly creating demand for a new generation of large computers.

ACRI is already planning to set up a sales representation to market its products in the U.S. and another one for the European market. As Stern emphasizes: "not necessarily headquartered in France."

## DEFENSE R&D

### Germany: Eurofighter Costs Drastically Increased

M11301090294 Munich SUEDEDEUTSCHE ZEITUNG  
in German 8 Dec 93 p 5

[Text] Development of the European fighter aircraft, the Eurofighter, is running behind schedule and the costs are escalating accordingly. The Defense Ministry is currently examining calls from the industry for several hundred million German marks [DM] occasioned by sluggish development, technical modifications, and the usual price increases. It is understood that a sum of up to DM670 million is at stake, only DM300 million of which are regarded as justified in Defense Ministry circles. However, the ministry does not intend to give an official assessment of the industry's demands until the Eurofighter has undertaken a successful maiden flight. This is not expected to take place until next spring.

The fighter's maiden flight has already been postponed several times because considerable technical problems have arisen in the flight control system. After Gripen-type test aircraft crashed in Sweden, the industry decided to proceed with extreme caution. The Defense Ministry now expects the maiden flight to take place in April 1994. Only when a test flight has been successfully accomplished will the ministry enter into negotiations over the increased development cost. The industry is, of course, prepared to bear part of the extra cost, because it is itself responsible for the delay in development.

At the Defense Ministry they say that the negotiations on the new development price will be extremely difficult and could take months, because the economic situation has hardly put industry in a mood for compromise. The industry's demand is referred to as mere figure-work that can only serve as a basis for an initial position. If the extra development costs were accepted, they could only be billed on completion of the development work, thus not affecting the Bundeswehr's current budget.

The technical and military requirements that the aircraft will have to meet so that the sale price can be reduced will also be decided by next spring. The heads of the air forces of the four countries involved (Germany, the United Kingdom, Italy, and Spain) will decide in January on the new performance specification. Defense Minister Volker Ruehe had referred to DM90 million as an ideal price, but the industry has so far scaled its calculations down from DM123 to 102 million. According to a Defense Ministry report, preparations for production are now scheduled to begin in 1996 owing to the development delay, so Parliament could vote whether or not to purchase the aircraft in 1995.

Daimler-Benz group subsidiary German Aerospace AG (DASA), which is based in Munich, does not rule out a withdrawal from the defense sector if the defense budget suffers further reductions. DASA intends to cut 2,500 of its remaining 11,600 jobs in its defense and civil systems business division by the end of 1996.

### France: Company Wins Contract for Polish Fighter Upgrade

BR2212091593 Paris LA LETTRE DU GIFAS  
in English 4 Nov 93 pp 1-2

[Unattributed article: "SAGEM: Nav/Attack Systems for Fighter Aircraft Upgrades: Belgium, Pakistan and Now Poland"]

[Text] SAGEM has been selected for the avionics system upgrade of the PZL Iryda I-22. The operation will take place on the PZL MIELEC premises, in cooperation with the Polish Aviation Institute, designer of the aircraft. The upgraded version Iryda M-93 will be provided with an inertial navigation system (SAGEM ULISS) wide field of view HUD [Head-up Display], HOTAS [Hands On Throttle and Stick] pilot interface, full color EFIS [Electronic Flight Information System] and extended attack capability. The first flight tests are due by the end of 1993. Qualification of MAESTRO [Modular Avionics Enhancement System Targeted for Retrofit Operations], the integrated Weapon Delivery, Navigation and Reconnaissance System designed and supplied by SAGEM is in progress to equip the Mirage III fleet of the Pakistani Air Force. Upgrade plans include extension of Air to Air operational performance and introduction of Air to Ground mode, to give the aircraft multimission capabilities. In addition, the aircraft will be fitted with multi-mode pulse doppler radar. A first production order was issued in June 1993. Two versions are being retrofitted,

the trainer/strike aircraft and the multirole fighter. Another version of this system, designed by SAGEM for the Belgian Air Force Mirage V has recently completed with full success an extensive flight test campaign. Full operational clearance was awarded by the customer in May 1993. Production phase has recently started for upgrade of 15 single-seat Mirage V BA and 5 two-seat Mirage V BDs, two aircraft versions are concerned, the trainer/fighter and the attack/reconnaissance. MAE-STRO (Modular Avionics Enhancement System Targeted for Retrofit Operations), with the SAGEM Nav/Attack systems for aircraft upgrades as cornerstone, provides capabilities at par with today's front line fighters. If features: Full inertial and GPS [Global Positioning System] performance (SAGEM ULISS or SIGMA)—TERCOR terrain contour matching for stealth navigation and blind attack (SAGEM EBS 1501 Bubble Memory)—Wide field of view HUD, FLIR (Forward-Looking Infrared) compatible (SAGEM Group IRIS FLIR),—HOTAS pilot interface (Hands On Throttle and Stick),—Air-to-Ground and Air-to-Air fire control including Radar or Laser Rangefinder—Self protection system (Radar Warning, Chaff and Flares)—All digital third generation mission planning system (SAGEM CIRCE 20001). SAGEM holds full flight test and qualification. The upgrade is performed within the customer's overhaul facility, enabling an extremely short turn-around and an increase of customer's support capability. The same system and methodology have been applied to a number of other aircraft: Jaguar International, A5, etc.

#### **Dutch Company Buys Ukrainian Ceramic Coating Technology**

BR1512162893 Amsterdam DE VOLKSKRANT  
in Dutch 15 Dec 93 p 2

[Unattributed article: "Limburg Company Develops Ukrainian State Secret"]

[Text] Amsterdam—The Interturbine Group is planning to build a new plant in Lomm, Limburg, where industrial and airplane turbines will receive a ceramic coating, which prolongs the life span of turbines considerably. Interturbine purchased this new procedure from Ukraine.

The project could yield some 35 jobs in the short term. Over the next few years, 20 million guilders will be invested in the plant in an attempt to commercialize the ceramic-coating process. Interturbine already has three plants in Lomm which repair turbines and produce engine parts.

The former Soviet Union Armed Forces had been applying the ceramic coating on the engines of MiG fighter aircraft for 15 years already. The coating protects engine parts against heat and corrosion. The United States has for years been trying to learn this secret formula to which the MiG's, among other things, owe

their good reputation. Until now, the West has been using a metal coating for turbines.

Airplane parts can be used for 4,000 hours longer after they have been treated. Turbines for use on the ground can be used for 15,000 hours longer, according to Interturbine.

#### **Belgium: Military Radar Firm Seeks To Boost Exports**

BR0712151393 Zellik BELGIAN BUSINESS EN  
INDUSTRIE in Dutch Dec 93 pp 38, 41

[Article by Luc Desmet: "Military Technology for Civilians"]

[Text] Belgian Advanced Technology Systems (BATS) supplied battlefield surveillance radars to the Belgian army and thus developed expertise in signal processing. It now wants to enter the civilian market.

At the request of the military market, BATS developed radars which are linked to other sensors, for example Doppler devices with video, infrared cameras, or image intensifiers. "The integration of radar with image technology provides an entirely different type of surveillance system," according to Gerald Lejeune, marketing director of BATS in the Sart Tilman technology park at Angleur near Liege. "The EUCLID (European Cooperation for the Long Term in Defense) consortium is talking about data fusion."

BATS is now expanding on its experience with the SCB-2130A field radar. SCB stands for "Surveillance du Champ de Bataille" [Battlefield Surveillance]. Since 1990, the company has supplied 25 radars of this type to the Belgian Army. This radar has a range of between 100 meters and 33.5 km. It can "see" tanks at a distance of 30 km and people at 15 km, but also registers low-flying helicopters and ULM [ultralight long-range missile] equipment. The practised eye of the operator picks out every dot on the Barco [Belgian electronics company] color screen. The entire surrounding area can be mapped out. The radar can operate in a network, via a connection to the BAMS field radio.

"What is known as the 33-km line of sight is virtually impossible to find in Belgium. The original intention was to use the field radar in Germany," says Gerald Lejeune—in particular with reconnaissance troops in Dellbrueck, where the radar would be fitted on top of three M-113 tanks in each of seven platoons. The restructuring activities implemented by Defense Minister Delcroix have turned these into four platoons, with the radar on three M-113's and one UNIMOG.

BATS is also exporting its radar. It has found customers in South America, the Middle East, and in Europe, but for a total of fewer than 20 orders. Gerald Lejeune denies that a BATS radar was exported to South Africa via Brazil.

In Europe and elsewhere the company has issued tenders for an export version of the battlefield surveillance radar and the border surveillance radar. The price of the export version is between 10 and 15 million Belgian francs, depending on the configuration.

"After all, every customer has individual requirements. If we adapt the software, the equipment is suitable for still more applications. An operational coastal version locates shipping movements. The radar can monitor airfields or register the impact of artillery and assist in directing the fire."

#### Civilian Market

Through the battlefield surveillance radars, BATS' expertise expanded in the field of signal processing. "We developed algorithms that were integrated into neural networks, fuzzy logic, and artificial intelligence," says G. Lejeune.

Up until two years ago, the company directed its expertise exclusively toward the military market. Since then, however, it has been seeking out commercial applications in the civilian sector.

An attempt to launch an ESA space project bore no fruit. As a partner in the European ESPRIT (European Strategic Program for R&D in Information Technologies) program, BATS is now developing a transmitter and a receiver for a wireless local area network. "In an industrial environment, the transmitter eliminates disturbing factors such as heat, vibration, shocks, and electromagnetic and other fields, using frequency hopping and spread spectrum. Until now, these techniques had only been used in military applications," explains G. Lejeune. This year, BATS is demonstrating its local area network in the Cockerill steel plant.

"We are also developing the 'autoreverse.' This is a small ultrasonic device mounted to the rear shock absorber of a vehicle, which gives out a warning when the vehicle comes too close to an obstacle."

The appliance is ready for mass production and contacts have been established in France and the United Kingdom. "We are hoping that services can be developed in the civilian sector in signal processing, microwaves, real-time software, quality control, and project management," says Lejeune. "If civilian activities expand, then a sister company will probably be set up."

#### Other Products

BATS' first product was a ground navigation system, for which Taman of Israel bought the production license.

This inertial system tracks the positions of the Belgian artillery and the reconnaissance troops' M-113 tanks, as well as the Netherlands Patriot launchers in Germany.

BATS has also spent three years working on a training simulator to train field radar operators in identifying typical signatures. The Belgian Army is buying one of these.

With assistance from EUCLID, the company is working on an automatic target classification system, and is now also offering its software knowledge as a supplier. "For example, we would really like to take part in SEROS II, the Air Force program that monitors traffic over Belgium," explains Gerald Lejeune.

As part of the CARAPACE program, BATS has been promised 300 million francs in indirect compensations. However, there is as yet no contract. Talks with main contractor Dassault Electronique are continuing. "We are confident," says Gerald Lejeune.

Within the C-130 modernization program, BATS is building the so-called hot bench for Honeywell, due for completion at the beginning of 1994. This is a test bench for aircraft electronics.

The company also receives direct compensations within the scope of the BEMILDAT program, which was allocated to the Canadian Northern Telecom. Until the end of this year, it will manufacture the electronic cards that will be integrated into the final product. BATS is also looking for a way into data fusion systems engineering.

#### Mixed Origin

In 1991, BATS and its 43 employees achieved a turnover of 425 million francs. Last year, that figure increased to 1.1 billion francs. Via Innotech, BATS is a 49 percent subsidiary of the Flemish Regional Investment Company. It belongs 51 percent to Eltem-Holding in Amsterdam—a company with no employees.

BATS was founded in September 1984. This was three months after the Ministry of Defense allocated 1.14 billion francs for the development and production of 25 ultra-modern battlefield surveillance radars. "Defense decided to develop its own radar from scratch, to satisfy specific operational requirements," explains marketing director Gerald Lejeune.

The development took three years. Elta of Israel, part of Israel Aircraft Industries, contributed its experience in hyperfrequency.

BATS, as integrator, used the services of, among others, Barco for the monitor, Britte for the precision mechanics, EMG for the support system and Electronic Apparatus for the circuitry. By the end of 1992, BATS had delivered all the systems and the logistics phase began—supplying replacement parts and documentation, training and maintenance courses. The contract covered both the development and the production and improvement of the device. Since then, the company has concluded 14 follow-up contracts.



### France: Aerospatiale Develops Remotely Piloted 'Spy Plane'

BR2611155393 *Bristol OPTO AND LASER EUROPE*  
in English Nov 93 p 11

[Unattributed article: "Fibre-Guided Spy Plane Flies 20 Km"]

[Text] Aerospatiale and Sogerma-Socea have developed a remotely piloted vehicle (RPV) called Pirat (Pirate), which both sends and receives data through a fibre optic cable. It flies up to 20 km from the operator.

The cable controlling the 2 m long RPV has been developed to resist the stresses forced on it by erratic movements. The aircraft itself weighs 20 kg and it is able to carry a payload of up to 30 kg, such as a TV camera.

Optical transmission of the collected data also means there is no "signature" so the data can be neither jammed nor intercepted, the developers claim.

Originally developed for "intelligence gathering in theatres of operation" the Pirat has been adapted to civilian projects such as security patrolling of inaccessible locations or industrial inspection.

The relatively cheap fibre link is intended to be an expendable item. It may be detached before the plane returns. Different recording devices may be carried by the Pirat's modular fuselage.

### Italy: Alenia's Military Aircraft Programs Discussed

MI3011185793 *ITALIA OGGI* in Italian 19 Nov 93  
p 19

[Article by Marco Tavasani: "400-Billion-Lire Order for Alenia"]

[Text] The minister of defense has solved the dilemma about the modernization program for the air force whilst waiting for the four-nation fighter plane, Eurofighter-2000, the delivery of which is planned for 2005. It has been decided to modernize 65 F-104S's and to lease 24 Tornado-ADV's (Air Defense Variant) from the British government for 10 years. This gives Alenia (Finmeccanica group) a deep breath of oxygen from the industrial point of view, and also under a social profile, as the modernization program for the F-104's will mean that no additional personnel will be laid off from the Turin factories.

Let us look at the two operations in detail. The contract was given to Alenia yesterday morning, and it is worth about 400 billion lire. It will ensure that the air force will have an interceptor fighter that, although it has an average life of 15 years, could acceptably carry out the role of short range interceptor fighter for another 10 years. The first renovated Starfighters, that will carry the initials ASAM (Updated Modified Avionics System) will be available for the four designated air bases at Cameri,

Grosseto, Istrana, and Cervia, 18 months after the placing of the contract. The interventions of Alenia, and the other national subcontracting companies, mainly regard rewiring and the substitution of other systems, as well as the installation of a new and more potent inertia platform to assure more precise navigation. The aircraft will be armed with two Aim-9L Sidewinder missiles with infrared guidance systems, and a couple of Aspide missiles with radar guidance systems, built by Alenia. The 65 F-104's that are to be modernized will be chosen by the air force from the 120 airplanes of this type in their possession, giving priority to the airframes that have suffered less structural fatigue, and the last one will be delivered three years after the start of the program. Substantially it is an operation that tends to increase the overall reliability of the aircraft, without noticeably increasing its operational capacity, that remains the same as that of a jet that is over 20 years old. The other operation provides for the leasing of 24 Tornado-ADV's, that the RAF [Royal Air Force] has grounded since the end of East-West tensions. It is an aircraft that has 70 percent in common with the attack version of the Tornado, that was used by Italy during the Gulf War. The most notable differences are found in the electronics system, which has been optimized for long range interception, and amongst other things the ADV has a potent Fox Hunter firing radar produced by GEC. In fact 173 aircraft of this type were built. It was developed by British Aerospace to meet the threat of the Soviet Backfire some distance away from Britain. The contract is worth 700 billion lire spread out over 10 years, 270 billion lire will cover the leasing, and 430 billion lire will pay for spares, assistance, maintenance, manuals, and training for the pilots, and intercept officers, that are the mission commanders. The 24 Tornados will be assigned to the bases at Gioia del Colle and Trapani, covering a gap in our air defense in the Mediterranean area. Without doubt this operation will have a decisive influence on the British-Italian policy agreements for the Eurofighter-2000 program, as well as guaranteeing sufficient work for the technicians of Alenia, avoiding the possible dismembering of the company's work force, to cover the three years that still remain before the European program starts at an industrial level.

## ENERGY, ENVIRONMENT

### United Kingdom: Electrolysis Used To Neutralize CBW Ammunition

BR1612154993 *Rijswijk POLYTECHNISCH*  
*WEEKBLAD* in Dutch 20 Nov 93 p 5

[Article by Joris Janssen Lok: "Electrolysis Helps Destroying Ammunition Mountain"]

[Text] Dounreay—A mountain of several hundred thousand tons of chemical weapons and conventional explosives is what we inherited from two world wars and several decades of Cold War. The actual scope of the

environmental problem is now becoming clear. A company located at the wild coasts of northern Scotland is offering a solution.

"After World War II alone, 65,000 tons of chemical weapons from German, British, American, Italian, Hungarian, and Russian origin were dumped into the Baltic Sea," says Bill Batey from the heavily protected nuclear facility of the British Atomic Energy Authority (AEA) at Dounreay, a privatized nuclear technology company. "Ammunitions were dumped also in the waters surrounding the UK and the Bay of Biscay. Now, after nearly 50 years, the shells start decaying and the release of highly toxic materials into the atmosphere is becoming a real threat."

#### Electrolysis

Batey's team of scientists have filed an international patent application for an environment-friendly chemical degradation process that can be applied to all explosives and chemical weapons such as mustard and nerve gases. They claim that the process destroys these substances without having to incinerate or detonate them. Incineration and detonation are unacceptable methods for environmental and cost reasons.

Batey is heading a division responsible for decommissioning nuclear reactors and managing radioactive wastes. Initially, the process was developed as an environment-friendly way to degrade low-level liquid radioactive waste. It is based on electrolysis and decomposes hazardous materials into the harmless substances CO<sub>2</sub>, water, NO<sub>x</sub>, and a small amount of acids, without any side effects. Batey: "We use silver as catalyzer for degrading organic phosphor compounds, which are found in explosives as well as in the nerve gases VX, Tabun, Sarin, and Soman. These are the gases mostly used by the United States, Russia, and the UK. To destroy chlorine compounds used in mustard gases, we use ruthenium as catalyzer."

The AEA entered into a joint venture with the Aberdeen-based company SubSea Offshore, which will implement its experience and specialist techniques to track and haul up the dumped ammunition and degrade it on board of a special vessel using the Dounreay method. According to Mark Vorenkamp, an American of Netherlands origin and director of the subsidiary SubSea Survey, "the AEA process is still in the laboratory stage, but plans are to integrate the electrolysis unit into mobile equipment which can be taken to the site of operations. It will be called 'Electrochemical Oxidation System,' abbreviated ECOS."

#### Billion-Dollar Market

In the meantime, SubSea has already acquired an advanced sea-bed research ship from the British Navy. The disposal of the gigantic military "inheritance" from the past century constitutes an \$8-billion market over

the next 10 years. This market is more or less evenly divided between Europe, North America, and the former USSR.

Not only old ammunition will have to be destroyed. According to the Chemical Weapons Convention, all chemical weapons will have to disappear worldwide. This will be done under the auspices of a UN organization to be established in The Hague. Together with SubSea, AEA has contacted the Chemical Warfare Center of the British Ministry of Defense in Porton Down, which will conduct further tests with the ECOS installation. Another British military center had already proved its efficiency with explosives.

#### Conferences

The large number of conferences and symposiums on the disposal of ammunition organized primarily in Germany indicates that it is becoming a pressing problem. This week, for instance, the northern German city of Muenster held a seminar on "Crossborder Environmental Problems Caused by Military Activities" of NATO and former Warsaw-Pact countries. Last month, the same city of Muenster hosted another conference on old chemical ammunition organized by the German Army and the Swedish SIPRI [Stockholm International Peace Research Institute]. In Munich, Deutsche Aerospace and an American interest group [not further identified] sponsored a conference on the removal of military pollution.

#### European Affairs: EC Artificial Intelligence Project To Control Pollution

BR1312154993 Zellik *TECHNIVISIE*  
(*TECHNOPOLIS* supplement) in Dutch Nov 93 p TP22

[Unattributed article: "New European Development Project"]

[Text] CLEAN is the name of a new EC-sponsored European development project which will examine and expand the use and possible applications of artificial intelligence in minimizing environmental damage and manufacturing costs. The project participants are Siemens, British Maritime Technology, and the Belgian University of Leuven, as well as the initial users of this intelligent automation technology, i.e., the Portuguese cellulose manufacturer "Cellulose do Caima" and the Netherlands paper factory "Roermond Papier." The CLEAN project will implement case-based learning methods to optimize the performance of production processes.

#### Belgium: Siemens Oostkamp Cleans Production Processes

BR2212115193 Zellik *TECHNIVISIE* in Dutch Dec 93 pp 7-9

[Unattributed article based on interview with M. Heerman, chief of Siemens' Oostkamp-based Laboratory for Production Techniques, and Engineer L. Danneels:



"New Structure for Electrical Appliances"; date and place of interview not given]

[Excerpts] The current structure of electronic subassemblies (for example, machine controls) is not recycling-friendly. This is partly due to the fact that an electrical appliance contains several of the elements in Mendeleev's table and, given the minute quantities of each element, dismantling and recovery is not really profitable.

The research department of Siemens in Oostkamp is specializing in making processes and production methods more environmentally-friendly. It has also looked at the structure of electronic appliances. This led, among other things, to a new way of constructing electronic subassemblies. This technique will now also be marketed outside Siemens. M. Heerman, chief of the Laboratory for Production Techniques of Siemens in Oostkamp, and Engineer L. Danneels talked about the new technique.

#### Environmentally-Friendly Production

[passage omitted outlining changes in environment legislation over the past five years] The environmental charges, which have previously been paid implicitly by the government (or by nature), are now increasingly being picked up by manufacturers. Given that this has resulted in the three environmental aspects—air, water, and refuse—gradually becoming the focus of attention, the realization slowly grew that blithely rotating the pollution between air, water, refuse, and energy is not an environmentally-friendly mode of operation. In any event, closer analysis showed that this method was also unnecessarily expensive.

#### Think Ecologically

Materials and energy flows were then examined and an attempt was made to minimize the total of all the flows. This is taking place first and foremost in the internal production process. Within Siemens' organization, Siemens Oostkamp has already successfully carried out instructions to "make part of the production process more environmentally friendly," on several occasions, particularly in German establishments. Making something more environmentally friendly can be by better streamlining of production (which means, for example, eliminating interim storage, and simply doing away with lubricating steel tools to prevent rusting, only to clean them again afterwards). Sometimes, it can be achieved by using different production methods (for example, using sludge-free techniques such as electrolysis when regenerating treatment baths).

One essential step in this process is that when new products and production processes are developed, those responsible should begin to think in terms of ecological balance sheets: The environmental impact of the entire process—from raw material to end-of-life product. In order to make it possible to prepare these ecological

balance sheets, Siemens Oostkamp has perfected a software package that can compare the ecological balance sheets of various production processes. This package is now being marketed by Siemens Nixdorf. In addition, right from the product development stage, attention must be paid to building in a certain level of "recycling potential."

#### Modifying Product Composition

Under pressure from the legislator, those in product development have also woken up to the obligation that certain products have to be taken back for recycling at the end of their useful life. Returning products was for a time restricted to packaging (and packaging refuse), but as of January 1994 electrical engineering manufacturers and distributors in Germany will also have to take back decommissioned products. [passage omitted on shortening life cycles of consumer electronics products]

Companies are therefore finding themselves up against a huge refuse mountain and do not know what to do with it—dumping is definitely not a solution the legislator will permit. The only answer is to break it up and sort it into raw materials which can be processed together, which is an expensive method of recycling material. Processing today's electrical appliances costs 3-4 German marks per kilogram if it is carried out by specialized, environmentally-conscious reprocessing companies. If Siemens were to take back all its appliances, that would mean 200,000 tonnes per year. To be profitable, these recycling costs have to drop, and this implies only one solution: Change the raw materials and the structure of the new products released on to the market so that material recycling becomes possible at the end of the product's life.

#### 'Original' Solution

Siemens recognized this problem some years ago. Around five years ago, its Central Research department was therefore given the task of finding a more recycling-friendly composition for electrical products. This work was carried out by Siemens Oostkamp. Its instructions were: "Not just green, but also blue," which means not only looking at the environmentally-friendly aspects, but also making sure that the new production method is cheaper and offers technological advantages! This led to what is known as the SIL [Injection-Molded Components with Integrated Conductive Paths].

So what does this involve? A normal electrical appliance is usually built up of various printed circuits, plug-connected to a board or independently mounted in a chassis and mutually linked via connectors and cabling. This is usually surrounded by a metal shield, so that the entire unit complies with EMC [electromagnetic compatibility] standards, which is then fitted with a housing. The components on the boards are usually cooled using special cooling fins. If this construction method is examined closely, it is obvious that it is a material-greedy and expensive (labor-intensive) method. This is due to the

separation of the functions of electronics, cooling, shielding, substrate, plug, and housing. Using the SIL technique, certain functions in the housing are integrated.

In the housing, the functions of EMC shielding, heat removal, plug function, and conductors between connector pins will be combined. This has been made possible by the choice of a strong, heat-resistant, injectable plastic. In addition, a suitable production method was developed for applying a copper layer to this plastic, a laser-based process was used to make a three-dimensional conductor structure from it, and a process was developed enabling soldering without causing damage.

#### Test Case Proves Viability

This method is used to build the substrate of a PLC [programmable logic control] circuit. The initial advantage is the reduction in components and suppliers. The old construction required 11 individual components (housing, EMC shielding, insulation, PCB [printed circuit board] with connectors and heat removal fins, and several sets of screws and bolts) from various suppliers, all of which of course had to be transported (also environmentally-unfriendly). Now, the housing with integrated pins, holders, and securing fins are all made in one piece, using the injection molding process. The metallization layer provides EMC shielding, heat removal, and conductor connections between the connector pins of the plug connection.

The second advantage is the level of recyclability of the product. The 11 functions are achieved using only two materials (plastic and copper), both of which can be recycled.

Advantage number three relates to economics. The production process is simpler, as a result of the short manufacturing time and the elimination of many suppliers. The test case also proves that production itself is clearly cheaper (if sufficient numbers are made).

The fourth advantage is the extremely fine laser structuring (approximately 100 micron), which means that the direct integration of SMD [surface mounted devices] or even bare integrated circuits or microengineering components is possible.

However, the big disadvantage is that this is all very new and still in the design phase. All the possibilities have yet to be "discovered." Prototyping is more difficult: As with a designer housing, making a model is difficult and time-consuming. For this application, the model was cut from a solid block. Siemens Oostkamp hopes that the use of stereolithography (making pieces from a CAD [computer-aided design] design using adapted machines) can provide an answer. Nevertheless, current experience is already teaching that this method is an ecological alternative to the present, non-ecological structure. Experience has yet to be gained.

Marketing has started: Siemens Oostkamp is offering its services to all electronics manufacturers wanting to learn how to integrate the new method into their products.

#### From Central Research Department to The Outside World

In the past, every major company had a large research and development section where technological development took place and, as a spin-off, improved production techniques were devised. Laser etching (writing to surfaces of resistances and capacitors, for instance, using a guided laser beam, which means the message can flexibly be adapted per component) was one of the techniques perfected by the Oostkamp plant of Siemens' Central Research department. Siemens' Central Research also financed Oostkamp's reorientation toward the development of environmentally-friendly production techniques, which started five years ago.

All R&D functions—the development of both technologies and products—were previously seen as strategic and were developed within the framework of a centrally controlled research policy. One company, no matter how large, can no longer afford to specialize in everything and carry out all the research and development it requires. Thus, for example, the development of general production techniques is no longer considered a component of core business research. For this reason, Siemens' Central Research department is gradually being slimmed down. One of the three departments in Germany was closed and activities in the Oostkamp-based research facility—which has already been mentioned above and which was the only foreign research team in this centralized R&D department—were reoriented. Oostkamp is now entering the market as a technical consultancy agency. The goal is clear: subcontracting for third parties. Logically speaking, it will enter the field in which it excels: environmentally-friendly production techniques for electronic engineering. Activities also include consulting with respect to process techniques, for example, making chemical surface techniques more environmentally friendly. These techniques were demonstrated at the IFEST fair in October. Oostkamp also wants to help other electronics companies to develop products and subassemblies using a new, recycling-friendly method.

#### European Affairs: High Hopes in Europe for Geothermal Energy

BR0301130594 Luxembourg INNOVATION PLUS  
TECHNOLOGY TRANSFER in English Oct 93  
pp 22-23

[Unattributed article: "Geothermal Energy: A Serious Alternative"]

[Text] European researchers have high hopes for geothermal energy. Thirty years from now, this energy source should be a serious alternative to nuclear power.

Geothermal energy is very different from other "alternative" energy resources such as wind and solar power,

because it has the potential to produce power at an industrial scale, of the order of hundreds of megawatts. Italy, for instance, already produces 500 megawatts of electricity per year this way.

The intention is to construct a giant underground heat exchanger linked to a turbine to test the industrial viability of this renewable source of power. However, significant difficulties include the economic and technical viability of recovering this energy in small fields (typical in Europe) and the high costs of hot dry rock research. Consequently, the success of the latest Community projects will determine the future of geothermal energy use.

Under the Joule II (non-nuclear energy) programme, scientists at Soultz-sous-Forêts (France, Lower Rhine) began work in December 1992 on a project consolidating research underway since the 1970s. The aim is to inject water into hot rocks at a depth of 4,000 m (in a granite platform criss-crossed by numerous faults forming a giant 'radiator' at 180 degrees Celsius) to produce sufficient energy to drive an electricity generator.

Two other sites are being examined in the United Kingdom and Germany. Some 60 scientists are involved in this project (ECU5.5 million, plus a further ECU3.3 million for 1994-95), from around twenty universities and institutes in France, United Kingdom, Germany, Sweden and Switzerland.

In Soultz, the first stage involves drilling boreholes through the sedimentary layer and granite platform, to prove the technical feasibility of an industrial-scale pilot with a capacity of several Megawatts. Equipped with a generator, this industrial pilot will be built after 1995. If all goes well, a prototype geothermal energy power station (producing 5-10 Megawatts) will follow around the year 2000. It will be linked to the electricity grid and work as a complement to traditional, small power stations.

Better understanding of the basement rock fracture systems has already allowed researchers to produce a model of a Hot Dry Rock reservoir. A 3,950 m borehole has been drilled and could form the first part of the future pilot system, while the next borehole (4,000 m deep) will be used to test the circulation of hot water. With these holes, researchers will be able to begin construction of the pilot and study problems like corrosion, pumping, and modelling (chemical and thermal) of the rocks.

Corrosion problems, which are crucial to the industrial phase, will be solved by removable internal tubing systems and/or injection of corrosion-inhibiting substances. Hydraulic models of the rocky massifs exploited (over 3,000 cubic km) will be made to check the impact on deep water resources in the region. Calculations show a balance could be quickly established between the pumping system and natural water circulation between the rock faults. An early estimate of progress and planning of the industrial pilot project will be presented in Soultz in 1994.

Whatever the future of geothermal energy, this research has already improved understanding of rock mechanics and drilling techniques. This knowledge will find applications in the oil and civil engineering sectors. Another spin-off has been the composition of an Atlas of Geothermal Resources in the EC, Switzerland and Austria, to be updated this year to include Central Europe.

For further information contact: Dr. Andre Gerard, Socomine, Route de Kulzenhausen, BP 39, F-61290 Soultz-sous-Forêts, France, Tel.: 33-88-80-53-63, Fax.: 33-88-80-53-51.

### **Germany: Siemens Water Recycling Cuts Capacitor Production Cost**

*BR0501134594 Paris ELECTRONIQUE*

*INTERNATIONAL HEBDO in French 16 Dec 93 p 36*

[Article signed E.F.: "Treatment of Waste Water Reduces Production Costs"]

[Text] The recuperation, in waste water, of 80 percent of acids used in the manufacture of capacitors is allowing Siemens to make savings of up to 6 million French francs [Fr] per year with the added bonus of environment protection.

Environment protection is no empty claim for Siemens, whose waste water treatment system is proving that an environment-friendly process does not necessarily cost more than traditional methods. The aluminum capacitor production plant of the Siemens Matsushita subsidiary in Heidenheim, Germany has recently put into operation a dialysis system which enables about 80 percent of the acids used in manufacturing to be recuperated and reused in the production cycle. The investment required to set up this system amounted to 1.2 million German marks [DM] (Fr4.3 million), which is less than for a traditional system (DM1.7 million). In addition, the annual production costs have almost been reduced by a factor of four (DM0.6 million instead of DM2.3 million).

### **Eliminating 6,000 Tonnes of Acid Sludge**

When waste waters are recovered after the aluminum etching stage in an aluminum capacitor production plant, they have strong concentrations of hydrochloric and sulfuric acids. Traditional water treatment systems include a neutralization phase followed by the separation of the liquid and solid parts. The liquids, which represent about 18,000 cubic meters per year in the Siemens Matsushita plant, are then drained via traditional sewers, while the solid matter, 6,000 to 7,000 tonnes per year, is dumped on a waste belt.

The new system is based on the same principle as dialysis, with a membrane which directly separates the waste water into two parts, one rich in HCL and H2SO4 acids (up to 80 percent can be recuperated) and the other rich in metals. The former (460 liters/hour) can be recuperated for use in acid baths during the capacitor



production cycle. The latter (470 liters/hour), composed essentially of alumina salt and a low percentage of acids, can be used in organic filtering stations where it acts as a bacterial precipitating agent.

### **Eureka Funds Rainwater Pollution Monitoring Project**

BR1901144494 Paris INDUSTRIES in French  
Nov-Dec 93 p 17

[Article signed Patricia Labiane: "A 'MUST' For Avoiding Water Pollution"]

[Text] Just one storm and everything is overflowing. The sewers spill out onto the land, the water is full of heavy metals and hydrocarbons, etc. Heavy rainfall can multiply by up to 10 times the rate of pollution recorded during periods of dry weather. Water treatment stations are not capable of handling pollution exceeding three or four times that for dry weather conditions and do not perform their regulating role. The MUST project, launched by the Corporation for the Treatment and Economic Development of Water [OTV], a subsidiary of the Compagnie Generale des Eaux [CGE], proposes checking the overflow of waste water after periods of heavy rainfall. The European scientific research program, EUREKA [European Research Coordination Agency], found the scheme attractive enough to award it its European label last June.

The Must technology will be implemented progressively over the next four years. Of the 96.6 million French francs [Fr] it will cost, France will contribute Fr32 million, Fr10 million of which will come from the Ministries of Industry, Post and Telecommunications, and Foreign Trade.

The project, which replies to a European directive of May 1991, combines 10 industrial partners from four Community countries. In addition to OTV from France, project leaders include the Danish pollution removal systems engineers I. Kruger, the Finnish chemical reagent producers Kemira Kemwater, and the British modeling researcher Wallingford Software. OTV, the European leader in the design and production of water treatment plants, is the prime contractor, assisted in France by other CGE subsidiaries: the Anjou Research economic interest grouping—which centralizes the group's research work—and Cochery-Bourdin-Chausse, specializing in road infrastructures.

### **Precise Statistics**

The project corresponds to a market with local communities estimated to be worth several hundreds of billions of francs over the next 20 years, a large share of which should return to the Compagnie Generale des Eaux. On the practical side of things, the project will propose "reservoir highways" underneath roads to collect rain water, new physical-chemical settling techniques for treatment plants, a system for storing the most polluted water before treatment, treatment plant biofilters that

are better suited to respond to large fluctuations in flow, sensors to inform the plant of the level of pollution in the water that will be arriving, etc.

### **Computerized Rain**

The project also envisages carrying out a whole series of statistical studies that will simplify the adaptation of water treatment equipment. Patrick Binot, OTV's deputy technical director and head of development, explains: "For a given period, a rainfall curve is run through a computer model to determine the amount of polluting substances released in an average year by a given network and treatment plant, which can thus be minimized." This gives a whole armory with which to face up to any rain shower.

### **Plans of Max Planck Society in Eastern Germany Noted**

#### **Research Build-up**

94WS0135A Frankfurt/Main FRANKFURTER  
ALLGEMEINE in German 2 Dec 93 p 38

[TEXT] After the "change-over" to German reunification, the Max Planck Society recognized its obligation to cooperate with the reorganization of research in the new states. It was not, however, ready to alter its views for the sake of rapidly establishing a unified structure of research in East and West. One of its principles is to establish a basic research institute only when there is an exceptional individual to lead it who represents an area of work, within a creditable and primarily academic field, which promises maximum innovations.

Therefore, according to President Hans Zacher in Berlin, an immediate program was begun in 1990, in which new and time-limited types of institutional research support were employed. To benefit university research in the East and at the same time to create appropriate fields for future Max Planck Institutes, so-called "task forces" were set up. Organizationally accompanied by the MPS and provided with "adequate" equipment, they were able to begin immediately and with "high scientific standards" in the universities in the new states.

However, they can only count on the support of the MPS for five years. By then they must be integrated into the current universities. To this purpose, agreements were made with the universities to appoint the group directors as university teachers, even though the universities were burdened with large surpluses in personnel. There was hardly any resistance from this side appealing to university autonomy in the choice of professors. The original goal of 25 groups has even been exceeded with a total of 28 task forces (270 positions) at seven universities in the five new states and Berlin.

In addition, according to Zacher, the MPS at the suggestion of the Council on Science converted two additional, long alien patterns of organization—also on only a time-limited basis: In Berlin two so-called branches of

existing MPS institutes from the old states began work. The one is looked after by the Max Planck Institute (MPI) for Extraterrestrial Physics, the other by the MPI for Plasma Physics, both in Garching near Berlin. Whether they will remain in this form longer than the agreed five years will be decided by a later investigation. It is said that even university affiliation, especially with Humboldt University in Berlin, is conceivable.

In the end the MPS saw itself compelled by the Science Council to do something for the humanities task forces worth preserving from institutes of the "Academy of the Sciences of the GDR." They did not appear to be suitable as cores of autonomous MPS institutes, because their directions in research (European Enlightenment, History of Science, Literary Research, Modern Orient, Middle Eastern European Culture, Period History and General Linguistics) could all be established at universities, even if this didn't succeed at first. They were therefore gathered in Berlin in seven "main humanities research foci," so-called centers—not, however, under the cover of the MPS itself, but under that of their own sponsor established for them.

Whether they remain more than alien elements is still open. Recommendations concerning their future were obtained from a commission which involved researchers from the outside in addition to scientists of the MPS. Accordingly, the centers are either to operate in cooperation among themselves with "close contact" with the universities or to be established there directly. The Science Council will make recommendations regarding their final status by May 1994 at the latest.

Until now there has been resistance by the universities against the new "categories" and disagreement between the federal government and the states on financing. The closer the centers are to the universities, the more certain will their financing be a state matter. If they remain separate from the universities, other ways of financing would have to be found. It is precisely this, however, which could be difficult; because newly founded institutions have for some time been blocked by the Federal Minister of Finance. According to Zacher, the existence of the centers might depend to a great extent on the duration or extension of the "start-up financing," which in the meantime is assured until the end of 1994.

Thus, the MPS will in the end give up all the institutions of their immediate program—task forces, branches, centers; they are only temporarily lodged with the society. In the meantime the attention of the MPS in the new states is mainly aimed at establishing institutes which strive for innovation. Seven institutes have already been founded. Both of the Max Planck Institutes for Microstructure Physics (Halle) and for Colloid and Interface Research (Teltow) materialized due to recommendations from the Science Council. The MPS has established five more under its own direction: the Institutes for Infection Biology and for History of Science (both in Berlin), for

Plant Physiology (Potsdam), for Economic Systems Research (Jena) and for Physics of Complex Systems (Dresden).

In the final stage, there should be 15 to 20 institutes in the east part of Germany. A density will thereby have been reached which is comparable to that in the old states, now with 65 institutes and independent research groups.

### Saxony's Plans to Create Jobs for Researchers

#### Researcher Potential Useful for Promoting Economic Development: New Model for Job Creation Measures

94WS0135B Duesseldorf *HANDELSBLATT in German*  
3-4 Dec 93 p 8

In Saxony they are trying to make a virtue of necessity. Businesses willing to settle in the rural districts of Floeha, Mittweida, and Zschopau can, for a limited time, make use of the manpower of unemployed scientists and engineers at no cost to themselves. In return, the small and mid-size firms must commit themselves to creating jobs in the region after a given period of time. The project is not without controversy. The Saxon FDP [Free Democratic Party] is afraid of government subsidized competition for research firms in the private sector.

Regions near Chemnitz are marked by the decline in the once dominant textile industry. After reunification, only a fraction of the jobs in this area of business could be salvaged. Manufacturing companies are still in short supply. Peter Daetz, Director of the Center for Economic Development and Advanced Training GmbH (CEDAT) in Floeha, made the point that "during the recession, we couldn't get anyone to settle here." Three rural districts of Saxony and the state of Saxony are partners in the non-profit CEDAT, which concerns itself with promoting economic development and a second labor market.

In spite of enterprise zones, low real estate prices and development programs, there was no apparent successful influx of people into the structurally weak area. When the Technical University of Chemnitz-Zwischau had to let almost 1,000 scientists and engineers go at the end of 1992, the promoters of economic development got the idea to offer this potential in research and development (R&D) at no cost to regional companies, to those establishing new business enterprises, and to investors from West.

The following model served: If a company, at no cost to itself, employs the services of a scientist for one year, it is obligated afterward to create two to three secure jobs in the region. Breach of this commitment results in the threat of contractual penalties. This measure of creating work is financed according to 249h of the Employment Promotion Act. There are currently 150 scientists and engineers available for this undertaking. "Since R&D



work is not being done for money, we are not giving any competition to private research companies," Daetz emphasizes. Representatives of Chambers of Industry and Commerce should guard against jobs eluding private companies.

The measures are handled institutionally by the Assistance Center of Middle Saxony (ACMS). Members are the CEDAT, the State, the Construction Company of Saxony, the District Savings Bank as well as the municipality of Floeha. Up to now the ACMS has been able to conclude ten contracts with companies, which created 60 secure jobs. By the end of 1994 the number should climb to 200. Without the R&D offer, these companies would never have come to Saxony—Daetz is certain of that. The FDP of Saxony is not sympathetic to the ACMS also getting government support. Around 10 million German marks are at the disposal of the ACMS for two years.

#### **Rhone Poulenc Extracts Rare Earths From Bastnaesite**

*Paris AFP SCIENCES in French 9 Dec 93 p 31*

[Unsigned article: "Rhone-Poulenc Is Considering Different Rare Earths Production Methods to Solve Waste Problems"]

[Text] Paris—Rhone-Poulenc announced on 6 December that it is considering producing its rare earths from bastnaesite, an ore purchased and preprocessed in China and the United States, instead of the monazite presently imported from Australia and whose residues create storage problems.

The fabrication of rare earths (15 chemical elements) from monazite generates residues with low radioactivity. This waste has been stored for the past twenty years at a specialized site in the Manche, but it reached saturation capacity in 1991 and Rhone-Poulenc had three years to find another solution.

The chemical group had considered storing the waste at the site of a former uranium extracting plant at Ecarpiere (Vendee), which raised strong local opposition. Lacking authorization for this site, and with "no storage solution found at the national level," Rhone-Poulenc is thinking about simply switching to bastnaesite for its supply.

This substitution implies shutting down the ore pre-processing plant at La Rochelle (Charente-Maritime) in September 1994, involving 65 jobs out of a plant total of 500. The decision however is not expected to cause any job losses as the employees will be reassigned at the site.

Rhone-Poulenc is the world's main producer of extracted rare earths, with 20 percent of the world's volume (36 percent in terms of value), ahead of the American Molycorp, the Japanese Santoku, and Chinese manufacturers. The group notably holds 65 percent of the world market for rare earths used in catalytic converters for automobiles. Rare earths are also used in luminescent applications (notably television screens),

electronics, and magnetic applications (audio recording heads, magnets, scanners), and optics.

#### **Germany: More Effective Waste Water Treatment With Biogas Reactor**

*94WS0148B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 7 Dec 93 p 8*

[Article by JB: "More Effective Waste Water Treatment With the Biogas Tower Reactor"]

[Text] Anaerobic biotechnical waste water treatment in bioreactors is today already being used by the food industry, pulp production, and paper manufacturing companies. The field of bioprocessing technology at the Hamburg-Harburg Technical University (Professor Herbert Maerkl, Denickestrasse 15, 21071, Hamburg) has now, in cooperation with Preussag Noell Wassertechnik GmbH, developed a new type of bioreactor concept for increasing the decomposition effects.

As reported by Maerkl, anaerobic biotechnical cleaning methods are generally held to be less effective than aerobic ones. This is due to the slow rate of growth of the anaerobic microorganisms. However, the decomposition effects per gram of biomass are comparable to those of aerobic microbes. For that reason, if it is possible to increase the biomass in the reactor, anaerobic methods are also very effective. This increase has been achieved with the biogas tower reactor from Hamburg by using the sludge bed process. Another problem with anaerobic bioreactors is transferring the generated biogas to the outside. Gas production can be so high that disposal is impossible to deal with or would lead to a loss of biomass through flotation. This problem is also solved by the tower reactor. Gas suction equipment has been built into the reactor container at various heights. This makes it possible to dispose of gas even at low levels. Technically, the suction equipment works by adding pockets in the form of sloping metal sheets in the reactor volume. They partition the reactor into several compartments connected with each other and catch the rising biogas. The gas bubble formed under the sheet can be drawn off through a vent placed there. By regulating the gas extraction at the various heights, it is possible to regulate the gas content so as to be uniform throughout the reactor. But the gas bubble under the pockets has other advantages as well. By means of the free surfaces formed on the liquid, floating biomass particles are also kept down. Therefore, the gas extraction is possible without loss of biomass. The pockets can also help when mixing the reactor content. It is important for the decomposition effect that the microorganisms and the added waste water are as evenly distributed as possible. Since some microbes live in the form of symbiotic agglomerates, this blending must have as little gravitational force as possible. This problem is elegantly solved in the biogas tower reactor.

If the gas under the pockets is not removed, it continues to rise upward over an overflow edge. Through built-in flow channels this creates a circulating flow in the liquid. It can be controlled by the level of gas removal. In this way various blending intensities can be regulated in the various compartments of the reactor. The requirement to achieve good blending in the lower reactor areas and a high storage capacity for the biomass in the higher areas is easily met. By properly regulating the blending, the inhibiting effect of hydrogen sulfide, which is created from sulfate in the waste water, can also be reduced.

At this time a 20-meter-high reactor with a diameter of one meter is being operated as a pilot facility. It has turned out to be successful in treating yeast waste water.

### EC Programs for Nonnuclear Energy Technology, Carbon Dioxide Emissions

94WS0117A Duesseldorf *HANDELSBLATT* in German  
24 Nov 93 p 34

[Article by Georg C. Goy of the General Directorate for Energy (DG XVII), European Communities Commission, THERMIE, Brussels: "THERMIE: EC Aid for Nonnuclear Energy Technologies; Small and Medium-Sized Companies Given Preference; Goals Are Energy Conservation and CO2 Reduction"]

[Text] *HANDELSBLATT*-TL, 23 Nov—For more than 15 years now the EC has been providing aid for the development, demonstration, and, lastly, also the first steps in introducing new, innovative, and efficient energy technologies on the market in Europe. In the process, almost 3,000 projects have so far been financially supported by the EC with a total of about 1.9 billion ECU [European currency units], initially through various demonstration programs and since 1990 through the new THERMIE (Energy Technology for Energy Control) program.

The THERMIE program (EEC Council Decree No. 2008/90, ABL No. 185 of 17 July 1990) is designed for the five-year period, 1990-1994, and thus ends next year. It is provided with an average volume of about 700 million ECU; that is, about 150-170 million ECU a year are available to promote nonnuclear energy technologies in the member countries.

The current debate in the Commission and the Council of Ministers on the inclusion of a successor to the THERMIE program in the EC's fourth general research program and the effects of the budget in connection with it will decide what sort of role aid for energy technologies will assume within the Community area in the future and also, based on it, to a greater extent in the countries of Central and Eastern Europe bordering on the EC as well as the countries bordering on the Mediterranean.

THERMIE concentrates on three main areas:

- Financial support for projects that promote innovative energy technologies that are ready for application;
- Measures for the introduction into the market and deployment of new energy technologies;
- Coordination of EC-wide as well as national, regional, and local activities in this field.

The THERMIE program enables the EC to provide financial support for:

a) **innovative projects:** These projects are expected to develop new kinds of technologies, methods, or products (TMP) for which the research and development stage has been essentially completed to the point of readiness for application and to promote new kinds of applications for already known TMP. This type of project is expected to prove the technical and economic viability of new technologies by means of an initial production run on a sufficiently large scale.

b) **dissemination projects:** The goal of these projects is to promote innovative TMP that have already undergone an initial production run, but which, because of ongoing risks, it has hitherto not yet been possible to successfully market and for which there are now really good chances of their wider application in the Community, whether it be under other economic or geographical conditions or with the aid of different technical versions.

c) **targeted projects:** If the Commission considers it necessary and has identified an unfilled public need, that is, significant technological advances are to be anticipated through cooperation between persons or firms from at least two member countries, the implementation of special projects, which must be oriented in terms of the Commission's detailed specifications, may be sponsored on the initiative of the Commission, that is, their coordination may be financially supported (so-called "targeted projects").

### Aid for Projects and Accompanying Measures

The THERMIE program covers all nonnuclear energy technologies that can make innovative contributions in the sectors:

- Energy conservation, that is, efficient use of energy, specifically in the subsectors: - buildings, - industry, - the energy industry, - transport and communications;
- New and renewable sources of energy in the subsectors: - photovoltaics, - solar energy, - biomass, - geothermy, - small hydroelectric power plants, - wind energy;
- Solid fuels, and;
- Hydrocarbons (oil and natural gas).

About 85 percent of the funds is earmarked for direct project aid and about 15 percent for "accompanying measures." The aid is provided in the form of a direct subsidy which does not have to be repaid even if the project is a commercial success, specifically, up to 40

percent of the costs that qualify for subsidization for innovative and "targeted" projects and up to 35 percent for dissemination projects.

The projects are to be implemented within the confines of the Community, but there may be exceptions. In any case, safety provisions and those relevant to the environment in effect at any given time must be complied with. When the cost of a project exceeds an investment figure of 6 million ECU, the applicants from at least two member countries must come to document the European dimension of the project. Furthermore, while, of course, basic technical feasibility and marketability of the technologies are required, there must also be difficulties in financing because of technical and/or economic risks in realizing the projects for which subsidies are applied for to obtain aid.

Projects that materialize through the collaboration of firms from several member countries, are to be implemented by small and medium-sized companies, and/or are established in economically less developed regions of the Community are given preference. The more of these criteria the applicant meets, the more chance he has of influencing the success rate of 1:4 (selected versus applied-for projects) in his favor.

This is to be viewed as a reform of the present program vis-a-vis its predecessors in that support for efficient energy technologies is not limited to only those projects that have already been subsidized by the EC. But rather THERMIE also provides aid for the introduction into the market of technologies that have already been readied for market as part of national or other public programs as well as by industry alone, that is, without any public subsidy.

The "accompanying measures" that are included in the THERMIE program as an additional reform are expected to in particular see to the dissemination of the results of the projects or reports on the respective technologies. They may not discriminate against any firm, but are available largely free of charge to interested parties as a service of the program and to improve market openness.

The most important tasks, which are covered by the organizations for the promotion of energy technologies, the so-called OPETS, set up to take care of them, apply to:

- The effecting of market studies as well as analyses of the chances of introducing innovative energy technologies and studies of the effects of environmental policy during on-the-spot operation as well as the importance of regional policy for them, and more besides,
- The dissemination of reports on the projects and technologies through the collection, editing, and preparation of informational material (brochures, leaflets, technical reports, translations into the language of the country); the organization of and participation in appropriate events, seminars, and conferences; the

organization of project tours for, for example, journalists and interested parties from inside and outside the country; and the development and maintenance of data banks (Sesame, etc.).

- The construction of transfer points (public and private) at local, regional, or national levels.

In selecting these OPETS, of which there are, at present, 40 throughout Europe, the Commission chose a decentralized approach that could fall back on individual organizations specializing in energy sectors in the member countries. They form a network of private firms (in many cases engineer's offices), professional organizations, public (energy) agencies and institutes that are active on regional or national levels and can if necessary fall back on a potential total of about 3,000 energy experts.

These OPETS receive financial support from the Commission for their cooperation in the amount of from 13 to 15 million ECU a year to carry out 200 actions within the framework of the THERMIE program.

In addition, with the Commission's decision of December 1991, some OPETS were commissioned to establish so-called EC energy centers in the countries of Central and Eastern Europe and to coordinate their activities. To date 14 energy centers in national or regional capitals of the former CEMA have launched their activities. Their job consists of in particular facilitating and promoting the transfer of knowledge and technology between the European Community and these countries.

Each of these centers is headed by a director appointed by the Commission who is supported by a local representative, a number of energy experts, and the necessary administrative personnel. In addition, if necessary energy experts from the member countries are also employed in them for certain missions subject to time limits.

#### Priming for Reproductions

Recent analyses commissioned by the Commission and conducted by independent experts prove that energy savings of or an energy production amounting to 1.5 million tons of crude oil units (ROeE) could be obtained with the help of the THERMIE program and its predecessors through the projects themselves (first application), and especially, of course, in the areas of efficient use of energy and exploitation of renewable sources of energy. This amounts to 0.2 percent of the EC's energy needs.

If we consider how the EC intends to allocate funds for this, namely by providing strong support through the THERMIE program, especially for all technologies for which a great potential for reproduction can be presumed, we get a more impressive picture of the situation. If we include those reproductions of successfully completed EC projects that have to date already been launched and are yet to be anticipated with a high degree



of probability, up to 18 million tons of ROeE—and, if the at this time known potential for these energy technologies is fully exhausted, theoretically even as much as 120 million tons of ROeE—a year can be saved or replaced with the aid of renewable sources of energy throughout all of Europe. In the process, CO<sub>2</sub> emissions in the EC could at the same time be reduced by as much as 15 percent and, of course, be applied to the current level of about 3 billion tons of CO<sub>2</sub> emissions in the EC. An achievement, therefore, that would have to make people sit up and take notice if we bear in mind the EC's goal of stabilizing CO<sub>2</sub> emissions in the Community at the 1990 level by the year 2000.

Realistically viewed, however, we have to assume that this potential would only have a chance of coming to fully full fruition with extraordinary efforts on the part of all those involved and substantially more favorable background conditions, which could benefit these energy technologies in, for example, the form of a constantly rising energy price level as they penetrate the market. Increased efforts are also necessary in areas other than immediate support for projects only insofar as they offer a realistic chance of attaining reduction targets as concerns CO<sub>2</sub> emissions through combined action.

EC-Supported Technology Projects in Energy Sector Up to End of 1992

	Number of Projects	Percentage of Total	Aid Funds in 1,000s of ECU	Percentage of Total
Energy conservation:	793	27.7	359,653	20.5
Buildings	149	5.2	31,475	1.8
Industry	469	16.4	233,164	13.3
Energy industry	95	3.3	57,732	3.3
Traffic	80	2.8	37,280	2.1
Renewable sources of energy:	1,085	37.9	371,943	21.2
Solar	374	13.0	84,573	4.8
Biomass	223	7.8	109,361	6.2
Geothermal	153	5.3	75,017	4.3
Water power	152	5.3	37,543	2.1
Wind	183	6.4	65,449	3.7
Solid fuels	221	7.7	419,199	23.9
Oil and natural gas	767	26.8	600,218	34.3
Total	2,866	100	1,751,012	100

Source: THERMIE.

### Plans to Expand Use of Wind Energy in Germany

94WS0118B Duesseldorf *HANDELSBLATT* in German  
24 Nov 93 p 31

[Article by Ortrun Bühling, German Research Service, Bonn, under the rubric "Course of Technology": "Wind Energy/New Technology Improves Availability/1200 MW by Year 2000. Government Subsidies Causing Flood of Applications to the Federal Research Ministry to Grow"; first paragraph is an introduction]

[Text] 23 Nov 93 (*HANDELSBLATT-TL*)—The coastal areas of Lower Saxony and Schleswig-Holstein blessed with a strong breeze want to cover, via ambitious subsidy programs, around five percent of their electric power demand by means of wind power by the year 2000. The construction of 8000 installations is planned in Lower Saxony alone. That such goals can be attained is definitely confirmed by a study prepared at the request of the Federal Ministry for Research and Technology (BMFT), that was to find out what contribution wind energy can make to the Federal Republic of Germany's energy supply in the next 10 to 15 years.

The authors' intent was to provide a picture as close to reality as possible. Therefore they investigated, in addition to the technical assumptions and economic factors, also whether financial backers were prepared to invest in wind power, whether the manufacturers of wind power units are able to meet the growing demand besides, and whether the today still tedious licensing process could slow development.

In addition, they investigated whether easy integration into the local power system would be ensured for areas having a favorable wind situation. Besides, they had to be outside wildlife sanctuaries and nature preserves in order to be included in the study at all. Wooded areas were also excluded, because, in the authors' opinion, the gain obtained by the exploitation of wind energy does not compensate for the loss that occurs by the clearing of forests. Taking all these factors into account, the study's conclusion is that it is possible to expect that in the year 2000 all the wind power installations in Germany together could generate approximately the power of a nuclear power plant (around 1200 MW).

However, without government subsidies it will go far worse for the future of wind power. At present the federal research ministry is administering the republic's largest subsidy program, the so-called 250-megawatt program, that grants operators of wind power installations an operating cost subsidy for a term of about 10 years, or optionally a one-time investment subsidy. The ministry has been struggling with a veritable flood of applications since in 1991, through an amendment to the electric power supply legislation, it became substantially more attractive for private operators to deliver to electric power companies electricity that they do not consume themselves.

#### **Climate Tax Could Spur Wind Wheels On**

However, the funds are limited because the program was established exclusively for research purposes. Facilities are being subsidized up to a total capacity of 250 MW, 120 MW of which are already in service, and BMFT has applications already today for an additional 1129 MW. However, the Federal Ministry of Economics would then be in charge of subsidy programs that exceed this scope.

Only the state programs of Lower Saxony and Schleswig-Holstein, that want to subsidize 2000 MW and 1000 MW respectively by the year 2000, offer substantial prospects. Accordingly the new states could be placed at a disadvantage when the federal republic's subsidy money runs out. Sixty-eight wind power installations having a total capacity of 11 MW have been erected there since 1990. This represents about five percent of the total wind energy capacity installed in Germany. This percentage can be increased to 20 percent by the year 2000, the authors of the study say.

Admittedly, the direct government subsidizing of wind power could become unnecessary with the introduction of the debated carbon dioxide tax. Because the construction of wind power installations is very costly, the use of wind energy because of an increase in the price of electricity would be substantially more economical. However, the introduction of the carbon dioxide tax will still fail because of the differing interests of several member countries of the European Union (EU). Therefore, the federal government is now considering the introduction of an energy tax at the national level.

Wolfgang Mayer's study published by Resch Verlag [Publishers] in 1992 under the title "Exploitation of Wind Energy in Germany," however, does not take into account the contribution technical advances could make toward the economic efficiency of wind power. In this connection, Graduate Engineer Aloys Wobben of the Enercon company in Wilhelmshafen recently presented the latest developments in this field at a Eurosolar show in Bonn.

In the meantime the company's first 300-kilowatt facility has been freed of several repair-prone and thereby expensive components. So, gears and linkages are unnecessary, because the rotor blades now transmit their mechanical energy directly to the electricity-producing

generator. Therefore the facilities can be built substantially more inexpensively. In Wobben's opinion the wind power units' technical development is still far from complete. He admits great prospects for a unit, developed within the EC's Wega-2 program, that has a capacity of one megawatt and is to come onto the market in 1995. Besides, technical innovations could result in the fact that locations in the interior also will be more attractive in the future.

But not even wind energy can fulfill the dream of a form of energy without any influence on the environment. Wind power installations can have a lasting influence on the migratory behavior of some species of birds. The birds shun their vicinity when looking for suitable resting places. They are a problem above all in proximity to dikes, because migratory birds use the dikes as orientation points. "We are for wind energy because we do not want to exchange nature conservation for environmental protection," says a supporter of the German Nature Conservation Alliance. However, the legislature's measures, like the guidelines for the erection of wind power units prepared by the Lower Saxony environment ministry, for example, have often not been sufficient. The protection of additional areas is necessary so that the "achievements in environmental protection do not" bring in their train "losses in nature conservation." To this aim the BMFT study also calls for further studies of the possible effects on the animal world of the use of wind power.

#### **ABB Develops Highly Efficient Gas Turbine With Two Combustion Chambers**

94WS0118A Duesseldorf *HANDELSBLATT* in German  
24 Nov 93 p 26

[Article by Dr. Hubert Lienhard, managing board member, ABBKraftwerke AG [Asea Brown Boveri Power Plants German Stock Corporation], responsible for the gas turbine and combined-cycle power plant division in Mannheim, under the rubric "Course of Technology": "Gas Turbines/Key Components for Efficiency of Combined-Cycle Power Plants/Output of 240MW Reached. Reheating Produces Maximum Efficiency"; first paragraph is an introduction]

[Text] 23 Nov 93 (*HANDELSBLATT-TL*)—So-called combined-cycle powerplants presently offer the most efficient technology for the considerate-of-the-environment "conversion to energy" of fossil fuels. Plants presently in service are today achieving efficiency of about 53 percent. An international team of ABB engineers has now succeeded, by means of a new kind of gas turbine design, in around two years of development work, in markedly pushing up the previous optimum value for combined-cycle plants. The thermal efficiency of the new gas turbines (the ratio of the input fuel energy to the effective output) is 38 percent in solo operation and reaches over 58 percent in the combined-cycle process. This means an around 10 percent lowering of specific fuel costs. Carbon dioxide emissions are



reduced to the same extent. The most powerful version of Th)0\*0\*0\*00T the new turbine generation (type GT26) attains 240 MW and accordingly has to be the most powerful gas turbine in the world at present. A 165-MW version is being offered for the 60-Hz market. The gas turbine is the key component of a combined-cycle power plant: In the gas-steam process, an approximately 1200-degree-Celsius hot compressed fuel-air mixture leaves the combustion chamber and sets the gas turbine rotating, which generates electrical energy in a coupled generator. Steam is generated by the over 600-degree-Celsius hot exhaust gases in a downstream waste-heat boiler, and this steam in turn impels the steam turbine. While the steam turbine process has largely been exhausted technically today, gas turbines still offer potential for development. While the efficiency of a gas turbine—of the then BBC installed in 1939 in Neuchatel in Switzerland—was around 15 percent, the most powerful of the turbines in service today reaches around 35 percent. The reason: Thanks to new kinds of materials and optimized blade and vane cooling, in the decades that have gone by, turbine inlet temperatures have been able to be raised from around 800 degrees to over 1200 degrees Celsius. Improvements are possible, even yet, by raising the inlet temperature further. However, substantial outlays have to be made for this that would result in only fractions of a percentage point. Therefore, the engineers at ABB banked alternatively on higher compression and two-stage combustion instead of on higher temperatures. The principal component of the new design is a multistage combustion chamber—the term sequential combustion is also used—in which the more highly compressed air is utilized twice in two turbine stages. Two combustion chambers are connected in series for this "reheating technology." The air drawn in leaves the compressor at about 30 bars (double the norm thus far in power plant turbines) and is swirled intensively with the fuel and ignited in the combustion chamber of the high-pressure stage, and drives the single-stage high-pressure-component turbine. So-called low- $\text{NO}_x$  burners get to be used here. The cooled, expanded, but still oxygen-rich mixture is led into the low-pressure combustion chamber, which operates with similar burner equipment. There fuel is again supplied and swirled and the mixture is ignited automatically and drives the low-pressure turbine stages. The pressure ratios are in keeping with those of conventional gas turbines (15 bars). An especially lean fuel-air mixture having a very high percentage of oxygen is burned in the first annular combustion chamber. The first turbine stage consumes approximately 60 percent of the total fuel required. The air for combustion is compressed beforehand in a 30-to-1 ratio in the compressor by the 22 flow-optimized compressor stages and arrives at the low- $\text{NO}_x$  burners through airflow ducts. There the compressed air is mixed with precisely measured quantities of fuel into an intensively swirling stream before the fuel-air mixture ignites in the combustion chamber. The especially intensive swirling of the fuel-air mixture is achieved by means of the offset conical half-shells of the

burners. The special geometry ensures steady independently "standing" flames in front of the burner members. A total of 30 of these low- $\text{NO}_x$  burners are distributed uniformly over the annular combustion chamber's circumference. Their simple design, in combination with the uniform distribution of the flames, reduces thermal stresses both in the combustion chamber and in the turbine. After ignition, the combustion gases flow through the single-stage high-pressure turbine and release part of their energy here before they are led further into the low-pressure combustion chamber. Advanced blade and vane cooling and the especially uniform temperature distribution—resulting from this annular combustion chamber's geometry—ensure the long life of the high-pressure turbine stage. In the second combustion chamber stage too, the still oxygen-rich combustion gases are led into premix gas burners that operate according to the same principle as the burners in the high-pressure section. The air is mixed intensively with the remaining fuel (about 40 percent). Here too no small flame retention baffles or similar components are required that are subject to heavy wear. This contributes to the machines' high availability and lowers maintenance costs. The cooling air is used in the combustion chambers almost totally as preheated air for combustion, so that cooling and efficiency are optimized equally. The long design of the second combustion chamber aids chemical  $\text{NO}_x$  reduction: A great part of the nitrogen oxides transported by the combustion gases is eliminated in the second stage. Advanced-design gas turbines and combined-cycle power plants have to demonstrate both excellent full-load values and good partial-load behavior. The advantages of multistage combustion chambers, relating to their design, have their full effect here. For one thing, only the first turbine [as written] stage is ignited at start-up. When quarterload is reached, the combustion gases from the high-pressure section have the temperature at which the second combustion chamber can be ignited and slowly flared up. The low-pressure-section turbine is consequently slowly heated when the machines start. The maximum turbine inlet temperature is reached not until full load here, but at quarter load in the high-pressure turbine. Controllable compressor stages aid steady partial-load behavior. No switching process or control action whatsoever are required during start-up. Besides, this technology involves the capability of using oil as fuel if gas is not available, with comparable output data. The design offers additional advantages besides a substantial achievement leap in efficiency: Because the turbine inlet temperature was raised only slightly considering the turbine, the engineers were able to fall back on known materials and proven processes. The substantial improvements in the matters of energy conversion and emission characteristics were realized by intelligently combining already proven techniques. The higher compression in the first turbine stage enables high specific output with a compact design. Thus, with this design one achieves power density not previously considered possible, and the mechanical loading of rotating parts is also relatively low. And

the environment benefits too: Compared with a conventional gas turbine (efficiency of around 34.5 percent), gas consumption is reduced by 33,000 tons per year in 6000 hours of operation, and 90,000 tons of the greenhouse gas carbon dioxide do not form at all. The lower fuel costs contrast with comparable investment costs per megawatt. There is still development potential remaining because of the disassociation of turbine inlet temperature and efficiency. An order has already come in from the United States: The Jersey Central Power & Light Company ordered the sister model the GT 24, designed for the 60-Hz market. This turbine, which has an output of 165 MW, is to go into service in July 1996. The researchers in their work were able to build on know-how in multistage combustion chambers and two-stage gas turbines gained by the engineers of the former BBC: Engineers at the Bezau power station in Switzerland implemented as early as 1948 a similar—though technologically very extravagant—two-shaft design. A total of 25 such units were installed, having outputs of between 20 and 25 MW. And a single-shaft two-stage unit having two silo-type [large diameter] combustion chambers connected in series was implemented in 1978 at the 290-MW Huntorf air storage gas turbine power plant northwest of Bremen. The Huntorf power plant is still in service today, just as are nine two-shaft units.

#### **Germany: Horizontal Drilling 5,000 Meters Deep Shows Promise**

94WS0134B Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 26 Nov 93 p 8

[Article by Wg: "Horizontal Drilling and 'Frac' at Nearly 5,000 Meters' Depth"]

[Text] Celle—For the first time in Germany, the technology of horizontal drilling, combined with multiple hydraulic fracturing of deposit rock at a depth of almost 5,000 meters is being used for a natural gas drilling project. As reported by Mobil Erdgas-Erdoel GmbH, the operator for a consortium, work is beginning in the next few days on the Soehlingen Z-10 project in northern Lower Saxony, in the vicinity of Rotenburg (Wuemme).

The goal of this technically innovative, expensive method is profitably to exploit a natural gas deposit with extremely thick rock and correspondingly low penetrability. In the event the project should be successful, this combination of two techniques would open up new prospects for natural gas exploitation in Germany.

At the Soehlingen gas field a 1,000-meter-long horizontal stretch is being drilled and equipped with pipe at a depth of 4,800 meters in the approximately 100-meter-thick main sand of the new red conglomerate geological formation. Along this stretch, at intervals of 200 meters, vertical, about 15-millimeter wide cracks will be produced. They are made by squeezing in a special fluid under extremely high pressure ("multiple hydraulic fracturing").

The cracks stretch in elliptical form about 200 meters horizontally and 100 meters vertically into the rock at the deposit. In order for the cracks not to close up again after this so-called "frac" treatment, high-tensile ceramic sand is pressed in along with the fluid, which remains as support in the cracks and keeps them permanently open.

The combination of horizontal drilling process and multiple fracturing of the rock is to produce clearly better "drainage" and thus enable satisfactory production rates. Horizontal drilling and "frac" methods are basically known techniques, but what is new is their combined application based on a difficult initial situation, which is marked by great depth, high pressures, and temperatures as well as the extremely low penetrability of the rock.

Heavy drilling equipment from Itag Tiefbohr GmbH is being used, with a special drive unit. The bore hole will be a total of 6,100 meters deep. The drilling time is expected to be about six months. The subsequent work operations will take another one and a half months.

With the new combination of techniques, the companies involved—BEB Erdgas and Erdoel GmbH (30 percent), RWE-DEA AG (30 percent), Wintershall AG (10 percent) and Mobil Erdgas-Erdoel GmbH as drilling and mining operators (30 percent)—expect profitably to develop a large proportion of the already proven natural gas content in the deposit.

#### **Germany: Ciliates Used to Detect Toxic Matter**

94WS0098d Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 28 Oct 93 p 8

[Unattributed Article: "Flight Reaction Indicates Impurities—Berlin Testing Procedure Uses Ciliates for Detecting Toxicologic Substances"]

[Text] Ciliates can detect and avoid toxic substances. This behavior called chemotaxis can be used for the detection of toxic substances in contaminated water. Based on this observation, scientists at the Free University of Berlin (Institut fuer Biochemie, AG Oekotoxikologie, Ehrenbergstr. 26-28, 14195 Berlin) developed a testing system for toxic compounds dissolved in water. Preliminary studies showed that the system containing the ciliate *tetrahymena thermophila* is versatile and sensitive.

As the scientists in Berlin report, the toxic substances cause typical flight and evasive actions. The extent of the reaction depends on the substance concentration. *Tetrahymena* is suitable as a testing organism because it is an intermediate step between bacteria and higher organisms, both biologically and ecologically. It plays an important role in the food chains in water. The biochemistry and physiology of the organism has been studied thoroughly.

The ciliate is used in three different test formats in Berlin. The testing apparatus basically consists of an outer chamber, into which an internal chamber consisting of 18 measuring tubes is inserted. The measuring tubes are connected with the outer chamber by fine channels.

In the initial test phase, the organisms are in the outer chamber. The test sample is in the measuring tubes. If they contain toxic substances, the ciliates avoid the tubes, otherwise they spread to both chambers. The measured value is the number of organisms which entered the tubes.

Another test measures how the growth of tetrahymena is inhibited when agents are added. However, this test is considerably less sensitive than the chemosensory test. The change in the membrane potential due to water contamination can be studied using fluorescent compounds; the sensitivity of this test is supposed to be similar to that of the chemosensory process.

In studies with chemical substances, which were selected randomly from the "European Inventory of Existing Chemicals", the test had a broad range and high sensitivity. However, the method is not suitable for continuous monitoring of the water quality.

#### **Status of Wind Power Generation in Germany Summarized**

##### **Investment in Wind Generation**

94WS0133B *BERLIN INGENIEUR DIGEST*  
in German Nov 93 p 51

[TEXT] By the end of 1992, there were 1,200 wind power installations in Germany. Rated output: 180 MW. Since 1974, the Federal Ministry for Research and Technology [FMRT] has promoted the use of wind energy, about 30 million marks are made available for this purpose annually. This makes a total of about 300 million German marks thus far—120 marks for large and 100 for small and mid-size installations, the remainder for R&D projects. Goals: acceptable costs for energy production with wind power, a noticeable contribution to the supply of electricity, reduction in energy imports, a broadening of the foundation of the energy supply, and a search for alternatives for the Third World. Through continued development in the technology of wind power installation, wind power generated current should become competitive by the end of the millennium.

Improvement in the technical availability of wind power installations is at the heart of the federal promotional program offered by the FMRT since 1989—"250 MW Wind". A good half of the installations within the scope of this program are operated by commercial enterprises, 30% by private investors, almost 15% by farmers, and 3.5% by local authorities and associations. Together with a scientific measurement and evaluation program (SMEP), the data from the promoted installations will be collected for ten years and evaluated. As an incentive for

their participation in the general test, operators of the windmills will receive from the FMRT a subsidy of six to eight pfennigs per kWh, plus 16.6 pfennigs for wind power generated current. Because of this promotional program, in 1992 growth in wind power installations was for the first time greater in Germany than in Denmark, the European leader (320 MW from nearly 2,300 installations). Worldwide about 2,300 MW are currently generated by from wind power. The USA has 15,000 wind installations with 1,600 MW in operation. In the EC countries the wind capacity is currently about 1,000 MW. The EC demonstration program THERMIE—which runs from 1991 to 1994—places emphasis on those energy technologies which would counteract the looming greenhouse effect through a reduction in CO<sub>2</sub> emissions. It is supposed to promote the market introduction of improved energy technologies and encourage cooperation across national borders. The energy research program JOULE II (Joint Opportunities for Unconventional or Long Term Energy Supply) also runs until the end of 1994. Within the scope of this program, a new generation of large wind turbines of optimal size and technology is supposed to be developed. Seven projects, two of them German, have gearless 1 MW installations as their goal.

#### **Status of Wind Power Generation in Germany Summarized**

##### **Wind Power in Saxony**

94WS0133A *Berlin INGENIEUR DIGEST* in German  
Nov 93 p 50-51

[TEXT] In seven years, Germany intends to be getting 2,000 megawatts of electricity from wind power, more than ten times today's level. To manage this increase, more facilities must be built in the interior of the country.

For mountain enthusiasts, the Hirtstein is a thoroughly insignificant hill in the Erz Mountains. In contrast, Dr. Wolfgang Daniels, Director of the Dresden firm of SachsenKraft GmbH, perceives a milestone in the hill. Not only are the first wind energy installations of Saxony there. But for the first time in Germany, after trials in the Eifel, a privately run wind field was developed on the crest of a low mountain range.

Connected to the power supply grid a good year ago, the mills already provide two million kilowatt hours—more than the 750 inhabitants in neighboring Satzung can use. Wind power could admittedly play a much greater roll in Saxony. Wolfgang Daniels, together with the Dresden engineering firm of Joerg Kuntzsch & Partner, co-initiator of the Hirtstein wind field, worked out a wind atlas for the free state (publication date: March 1994).

**Wind Fields** In the neighborhood of the Hirtstein alone, 12 additional wind fields could be established. Four



projects are actually already in the planning and authorization stages; among them are those at the Oberwiesenthal border and in Joehstadt, where installations with a total rated output of 3.5 MW are to be erected.

"Naturally it is not our goal to plaster the upper Erz Mountains nature preserve with modern windmills," says Wolfgang Daniels to ward off objections. But there, where it is possible and economically sensible, the mountain wind should be used to produce clean energy. Decentralized wind power installations could, according to Daniels, meet up to 50% of the electric power needs in some administrative districts in the Erz Mountains. Saxony's Minister of the Environment Arnold Vaatz even considers half the state to be suitable.

Without opening up new regions of the interior to wind energy, the goal of the Federal Ministry for Research and Technology cannot in any case be achieved. According to assertions from Bonn, the 2,000 MW limit should be reached in the year 2,000. Wind energy would then still only come to a modest 0.2 to 0.4% of the electric power produced in Germany today. Still, that would mean an annual reduction in CO<sub>2</sub> emissions of around four million metric tons.

#### **Oekostrom Project in Saxony: Windmills On the Hirtstein.**

Germany's neighbor to the north, Denmark—the world market leader in the business of wind energy—is much further along. Finn Hasted, certified engineer and Director at Elkraft, the Danish producer of energy installations, knows that by the turn of the century 2.5% of the country's electricity needs should be met by windmills. The Danes are increasingly going into the ocean—they are even already experimenting with 1 MW off-shore installations.

In order for Germany to make progress in the business of wind energy, it is especially important, according to Bernd Neumann, the Undersecretary of State in the Federal Ministry for Research and Technology (FMRT), to further reduce the costs of energy production from wind installations. Even without government promotional measures—the FMRT development program is to expire in 1995—they must become competitive. Because of the high cost of the installations, wind energy today still costs, relative to the kilowatt hour, up to five times as much as conventionally produced electricity.

Promotional rates and conditions for the installations costing between 1,000 German marks (rated output: 0.07 kW) to 1.5 million German marks (600-800 kW)—almost 100 types are available on the market—have until now varied greatly from state to state. Dr. Daniels is also skeptical then regarding the effectiveness of federal promotional politics: "It doesn't lead to any real introduction into the market." Getting on the market is also hampered by the slow process of obtaining authorization and by resistance on the part of public utilities to the unwelcome competition from private wind power operators. Although obligated for more than a year by the

energy supply law to pay producers 16.53 pfennigs per kilowatt hour, the public utilities continue to try to push down the price; or they pay, but slowly.

Wind power installations in the interior, according to Daniel's counterproposal, should in general be compensated by 150 percent of the average end-user price (27 pfennigs) per kilowatt hour. For example, Aachen: here, since September 1992 per council decision, Oekostrom must be compensated for costs—still against continuing resistance on the part of local producers of electricity.

Such compensation would also help the eastern part of Germany to catch up with windmills. At the end of 1992 the propellers of around 1,200 wind power installations were rotating in Germany, only a few of these in the new states. The leader here, as west of the Elbe, has long been the North. By April 1993 there were 43 installations in the coastal state of Mecklenburg-Vorpomerania, according to the Institute for Solar Energy Production Technology at the Polytechnic in Cassel (ISEPT). In Sachsen-Anhalt there were just eight, in Saxony seven and in Thuringen only two.

In Brandenburg five windmills have by now fed 1.5 MW of electricity into the public grid.

In summer the Potsdam Ministry of the Environment presented a study on the wind potential of the country, which was worked on by the Kraftwerks- und Anlagenbau AG [power station and installation construction company] in Berlin, the Kuntzsch engineering firm in Dresden and the Green League. The first wind field in the Brandenburg brown coal region is to be on the tip of a 300 meter tall overlay near Cottbus. Ten wind power installations each with a 500 kW output will send electricity over a five kilometer long underground cable to the Jaenschwalde power station, from where it will enter the VEAG grid. This capacity—five Danish and Dutch wind power installations—was placed on the Hirtstein within a period of a year by the Daniels/Kuntzsch duo. Rated output: 1,025 kW at a wind velocity of 10 to 13 m/s.

Unexpected stresses from the weather and surprising technical difficulties created problems. "Quickly changing wind directions, frost, snow accumulation and sleet made it hard to manage rotor wings and control technique," Daniels remembers. The operators defrosted the rotors with 300 W halogen lamps, and in the future UV lamps are also supposed to be installed.

With the mills made by the producer Micon which have actually been tested in practice, switching generator levels did not work at first and the hydraulics of the windbrakes leaked. Downtimes quickly grew to 15%—two million kWh less than predicted.

Still, Daniels is certain that wind energy production on the crest of the Erz Mountains is proving its worth: "A few hundred windmills could soon be turning on both sides of the German-Czechoslovakian border. This could check the poisonous fumes coming from the brown coal

power plants in the Bohemian basin, which are killing the forests in the Erz Mountains."

In the meantime, the wind power pioneers have even won the support of the locals in the Erz Mountains. At first they had to take a good look at a citizen's initiative. The most important counter arguments: Windmills are too loud, they have a negative affect on the landscape, and they are a danger to birds.

### Shutter Mills

The last objection has been refuted by studies carried out since 1984 in Holland and Lower Saxony and by experience in Denmark and Sweden: High-tension lines and lighthouses kill more birds. As for noise, Daniels concedes that "the beating of the rotor wings can be heard at distances of 200 meters." Improved operation, higher aerodynamics of the wings, and soundproofed gondolas are still challenges for engineers.

Through personal conversations and the invitation to evaluate and discuss the wind field project, the project planners are finally bringing about a swing in opinion. Since it is been clear that the project is useful to the community and is not costing them money, acceptance is assured. When the mills stop now, Daniels reports, "the people living in Satzung call me even in Dresden and ask why Snub-nosed Karl, White Lady, Jolly Hans, Mazze-bille [as written] or Old Hannes are not running."

### Germany: Redevelopment of Environmentally Contaminated Industries in East Called For

#### Issues Described

94WS0113A Berlin *INGENIEUR DIGEST* in German  
Oct 93 pp 10-11

[Article by Thomas J. Bencard, Ines Bronowski: "Costly Compromises"]

[Text] The district attorney's office in Halle and the criminal police in Eisleben are now bringing charges for subsidy fraud in connection with the cleanup of ecological contamination in the new laender. As far as is known, millions have been paid out from the Trust Agency and land treasury through Trust Agency-owned Mansfeld Umwelt- und Recycling GmbH and the non-profit cleanup company Mansfelder Land to the Eisleben recycling company MFD, without the corresponding work having been done.

What was brought to light in the Mansfeld region indicates what is in store for the federal government and the laender from the regulation on financing the ecological pollution. This business of the cleanup billions, which the taxpayers have to come up with, has triggered a boom in a highly profitable market—and for dubious suppliers as well. After the Mansfeld scandal came out, Hettstedt district administrator Hans-Peter Sommer, for

example, demanded that Trust Agency chief Birgit Breuel impose public oversight of contracts, performance, and payments.

Here things are not so good. In many cases Birgit Breuel's Berlin agency has issued insufficient regulations for the treatment of ecological pollution in privatizations, criticized the Federal Supreme Auditing Institute in its most recent annual report:

- In the privatization contracts the concept of "ecological pollution was predominantly not unequivocal and not uniformly applied;" even the cost of cleanup, restoration, and maintenance costs was extra.
- In one out of every two contracts signed by the end of 1992, the Trust Agency did not limit its cost liability.
- As late as the second half of 1992, in four out of 10 contracts the Trust Agency had not locked in "the participatory rights which, among other things, assure the authorization and followup of ecological pollution measures by the Trust Agency."

The agency is trying to play down the whole thing. "The Auditing Institute," dismisses Heiner Bonnenberg, among others, head of the Trust Agency's Directorate for Environment and Pollution, "criticizes everything we do." He has to admit, however, that "oversight is in fact our problem." The reason: According to Bonnenberg, many privatizations were completed under "time and quantitative pressure." Without compromises many interested buyers would probably simply have turned away for fear of incalculable pollution risks.

The Trust Agency often had to make pragmatic decisions. For this reason the Trust Agency, before the 22 October 1992 Federal Government-Laender-administrative agreement on sharing the cleanup costs, agreed to participate extensively in the cost—in some cases up to 90 percent. About 3,000 contracts, perhaps even 1,000 more, contain such agreements.

No one knows what the actual cost of the cleanup will ultimately be. To be sure, with its "pollution assessment" instrument the Trust Agency has tried to achieve an overview of about 3,000 cases within two years. Without clearly defined opportunities for cooperation and control, however, that will scarcely be enough.

In the Trust Agency's "planned final balance" of 270 billion German marks [DM], Trust Agency head Breuel insists that, out of precaution, she has reserved funds amounting to DM 12 to 15 billion for environmental cleanup. Will that be enough? "There are always surprises," Birgit Breuel concedes.

Another uncertainty factor in the billion-mark poker about pollution is the definition problem: How far should the cleanup actually go? At least in the privatization contracts, the Federal Supreme Auditing Institute charges, there are no such specifications.

This problem could be expensive not only for the Trust Agency. Environment Minister Klaus Toepfer, at any

rate, fears that for the billion-mark amounts which various expert estimators mention "one could probably return the soil of the entire ex-GDR to its virgin state." Cleanup can thus mean only one thing to Toepfer: Making subsequent utilization of each surface possible without danger for humans and environment.

The minister therefore urgently requests passage of the Federal Soil Protection Law, which exists as a draft bill and is now being sent around for comment. The draft bill provides for nationally uniform specification of the demands for pollution cleanup by means of legal regulations. This would pave the way for the Technical Soil Directive demanded by Toepfer, which is to establish exact criteria for the condition of the soil for certain applications.

It has not even been clarified how, after the Trust Agency concludes its operational business in 1994, the pollution agreements are to be continued. "Whether another successor institution will be created," says Bonnenberg, "or whether a department of the Federal Ministry of Finance will take over, has not yet been determined."

#### Projects, Costs

94WS0113B Berlin *INGENIEUR DIGEST* in German  
Oct 93 p 11

[Article by IBO: "Billions for Large Projects"]

[Text] In the new laender and Berlin (East) 66,909 areas suspected of being polluted have been found so far (as of August 1993). Then there are another 4,394 areas suspected of military and weapon pollution. These figures have been reported by the Federal Environment Agency in Berlin.

With the "Administrative Agreement on the Regulation of Ecological Pollution" (Administrative Act on Pollution Financing, Federal Gazette No 58, 25 March 1993, p 2842), the Federal Government and the new laender have agreed to share the costs. This agreement ties in with the exemption clause in the Environment Law. According to it, the responsible land authorities in eastern Germany may exempt investors from liability for already existing pollution. In all, more than 60,000 such exemption applications have been submitted, but until now only a fraction of them have been decided.

For the exemptions which receive a favorable decision the administrative agreement provides that the Trust Agency and the land, with commensurate participation by the buyer (at least 10 percent), share the costs at a ratio of 60:40. This regulation applies to existing Trust Agency businesses or those privatized after 1 January 1992.

For the so-called large projects, the cost sharing is 75:25. For the Large Brown Coal Cleanup Project the financial basis was set at DM 1.5 billion annually until 1998. For the Large Chemical Project, with the individual projects Buna AG, Leuna-Werke, Filmfabrik Wolfen, Chemie

AG Bitterfeld and Hydrierwerk Zeitz, about DM 2.3 billion must be anticipated, according to present estimates.

For another 14 large projects agreed on by the Trust Agency and the laender, a funding requirement of about DM 100 million, respectively, is assumed. These projects are:

- Berlin: The region of the Spree Industrial Area (Adlershof, Rummelsburg, Ober- and Niederschoeneweide, Johannisthal sectors)
- Brandenburg: The Kreis Oranienburg region (Hennigsdorf, Velten, Birkenwerder, Oranienburg, Hennigsdorf Business Park sectors)
- Mecklenburg-West Pomerania: Neptun-Warnow-Werft Rostock, MTW Schiffswerft Wismar
- Saxony: Saxonia AG Freiberg, Olefinwerke AG Boehlen-Lippendorf, Lautawerk GmbH
- Saxony-Anhalt: Erdoel/Erdgas-Gommern GmbH (Salzwedel/Peckensen development region), Mansfeld AG (Rohette Helbra, copper-silver mine), Magdeburg Rothensee region)
- Thuringia: Kali-Werra AG (Merkers), Kali-Suedharz AG (Sondershausen, Bleicherode, Sollstedt, Bischofferode), Rositz Administration and Third-Party Rights Exploitation Association.

In addition to these billion-mark sums, the federal government is providing another DM 13 billion for accident prevention measures in the region of the Wismut enterprises.

#### Contamination of Silbersee

94WS0113C Berlin *INGENIEUR DIGEST* in German  
Nov 93 p 52

[Article by Juergen Grubitsch: "The Dirt in the Silbersee"]

[Text] Put a lid on and leave it, some recommended, but others dreamed of a recreation area with a beach for swimming and gondola trips. The object of this fantasy: The 14-hectare sludge hole between Bitterfeld and Wolfen, where an evil mixture of sulfite lye, lignin, cellulose, sulfates, bleaching waters, hydrogen sulfides and carbon disulfides, salts, alcohols, phenols and solvents is swimming. For years, toxic waste from the Wolfen film factory created the pool of muck, which—because of its shimmering surface—after the unification became world famous as Silver Lake.

Now, a company in the region wants to perform a miracle and free the residents of nearby Wolfen-Wachtendorf from the stench of this sewer. The Sangerhaeuser Maschinenfabrik (SAMAG), which, together with its subsidiaries, takes part in the cleanup of the former film factory, promises to return the water to ecological balance with its Aqua-life unit.

To begin with, a large-scale test has been under way since June. Independent environmental laboratories are



taking samples every day and checking on the progress. The decision is to be made at the beginning of October. Then, if this succeeds beyond all doubt, a large assault can be made with additional equipment even this year. This is aimed first at the surface of the Silbersee. "The thin layer of water over two million cubic meters of sludge must first resume its function as a hydrological stopper," SAMAG's laboratory chief Axel Koenig explains the principle. This plug will first be enriched with atmospheric oxygen. Then the developing harmful gases will already be oxidized and mineralized below the surface, Koenig anticipates. At the same time bacterial cultures are to initiate biological breakdown processes. The cleanup people's vision: Complete food chains from microorganisms to fish are to be recreated in the oxygen-rich water. Later on, the "disarmed" sludge could be dredged up almost without odor and burned.

The cleanup is not without risk. To be sure, in the jelly-like mass of the pit there are only small quantities of heavy metals, says Koenig, and the ground water is protected by a barrier of lignin. The real difficulty threatens on top: "A major danger is that with large additions of air into the not quite 30-centimeter-thin layer of the surface water, the entire brew will begin to churn," the laboratory chief fears.

Within the space of three months microbiologists, flow technicians, designers, engineers and workers designed and built a "special ship" which is to overcome the problems: At the end, they gave the discharge from the mobile water purification unit the form of a snout. It avoids swirling up the shallow water.

The technical principle is a Venturi system that sucks up polluted water. In the aerator part it is squeezed through a "throat" and mixed with air, which intensifies the oxygen absorption of the water. Subsequently, the water passes through a 15-meter-long flow channel with columns of biological growth surfaces. When the light, oxygen-rich mixture flows through, on the one hand it promotes the growth of microorganisms. On the other, it tears off the overhanging part of the growth and carries it off with the water. That is how new life is supposed to originate.

Naturally, SAMAG administrator Eckart Harrmann is more fascinated by the economic than the technical aspects. "If we get the final contract for cleaning up the Silbersee, with another six to 12 units it will become a million-mark deal," he calculates. The image of "having cleaned up to some extent" the notorious sewer would be a priceless reference "in the eyes of the world."

Even now, Harrmann convincingly praises the Aqua-life purification system from Sangerhausen. It can be used in creeks, rivers, and standing waters as well as in conventional treatment plants. All it needs is a power supply. Harrmann adds: "The cost of hiring our services until the end of a cleanup mission is low." The company thus accommodates the strained financial situation in many companies and municipalities.

## Netherlands: Clean Electrical Generation from Coal Gasification

94WS0032A Rotterdam NRC *HANDELSBLAD*  
in Dutch 8 Oct 93 p 12

[Article by Theo Westerwoudt: "First 'Clean' Electricity from Coal Gas: Production at New Power Plant in Limburg Will Be More Ecologically Sound"]

[Text] Buggenum, 8 Oct—In the Limburg town of Buggenum on the Maas, in the municipality of Haalen, near Roermond, a remarkable example of technological innovation is being realized, intended to help the Netherlands continue using pit coal as one of the most important fuels for generating electricity. But this in a way that is noticeably friendlier to the environment than that to which we are currently accustomed, with less discharge of noxious emissions and dust, better quality, and more recycling of residues.

Right next to the Maas Power Plant, a large conventional coal-burning plant for generating electricity that is scheduled to be shut down in 2000, the Cooperating Electricity Production Enterprises (SEP) have built a demonstration plant that is to gasify coal based on a process developed by Shell. This new power plant, with a capacity of 253 megawatts of electricity (MWe), is currently the largest of its kind in the world. The system must prove itself during a three-year demonstration phase. If successful, a big brother of "Buggenum" will be built in Borsele, Zeeland, with a capacity of 600 megawatts.

The part of the Limburg installation that generates electricity is already operating on natural gas as an element of the startup program, and is providing 100 megawatts of electricity to the public network. In a few weeks the colossal coal gasifier will also be started up, says Eng. G.D. Zon, the project director of Demkolec, a subsidiary of the SEP set up specifically for the new project. After that, the capacity will be gradually increased to the maximum. Ultimately the power plant will process 2,000 metric tons of coal a day.

According to Zon, the electricity that his installation will then deliver is still about 20 percent more expensive than that coming from a 600-megawatt powdered coal plant, but "Buggenum" is intended to be a model for the large-scale application of coal gasification. "At a capacity of 600 megawatts with high efficiency, the production price is competitive. But we are primarily interested in the environmental advantages. If all this succeeds, and you put price tags on all the aspects, then I think that a coal gasifier will end up being cheaper."

Coal gasification is not a new technology, as many Limburgers in particular know, because right in front of city hall in Maastricht stands a statue of Father Prof. Pieter Johan Minckelers, who discovered 210 years ago that heating pit coal in an old barrel releases gas that is well-suited to launching hot-air balloons and to lighting and heating. Since the beginning of this century, the

system has been applied by municipalities on a large scale for the production for city gas, but in the 1960's it was supplanted by cheaper and much cleaner natural gas. For decades, industry has used the cheap gas obtained from the production of coke, and during World War II the Germans made synthetic gasoline from coal gas. Beginning in 1935, tests were also conducted with the underground gasification of pit coal, but this has yet to yield commercial success.

Coal gas as a fuel for generating electricity is indeed new. In the late 1980's, Shell emerged as the winner of a bitter struggle with competitors Texaco and British Gas Lurgi and was able to provide the SEP with its technology, which came from the technique that the company uses for oil gasification. All the oil companies threw themselves into gasification technology during the 1970's, says Eng. Zon. "After the first oil crisis, they expected a shortage and a sharp price increase for oil and natural gas. Because of that, the raw materials for the petrochemical industry would also become much more expensive, and so an alternative was sought. Synthesis gas, which is created from coal gasification, is also suitable as feedstock for the chemicals industry. That is why you now see all the oil companies following this route. They have invested a great deal of money in it. Coal gasification also generates hydrogen, and the petrochemical industry always needs that. And it is easy to combine the carbon in the gas with the hydrogen to create substances that you need in the chemicals industry."

Modern natural gas-fired electric power plants can easily achieve efficiency of more than 50 percent or even a little higher. The test installation in Buggenum achieves 43 percent, because of the applied technique. "Just look at our STEG unit (steam and gas are both fed into turbines and the power is converted into electricity via a generator) and then we will achieve more than 50 percent," says Zon. "Then you have to consider that we produce our own gas, while a natural gas plant has its fuel delivered ready to use. But for this sort of power plant there is an entire battery of equipment that treats the gas and keeps it under pressure."

According to the director of Demkolec, a 600-megawatt coal gasification plant should be able to achieve efficiency of 47 percent, and theoretically even 50 percent. But Zon is no fetishist; he points out that the most modern powdered coal plants will match the performance of coal gasification in terms of efficiency and environmental properties. "I think that you should install both systems side by side, in a competitive relationship, with regard to power plant availability, cost per kilowatt hour, and environmental performance." This opinion diverges from the Master Plan for Electricity Supply, in which the government, if "Buggenum" is successful, expresses a preference for pit coal gasification alone in generating electricity, aside from the two other fuels: natural gas and uranium.

The government and electricity producers are in complete agreement that coal is absolutely essential to the

large-scale generation of electricity. In the 1970's, the ideal mix of fuels was determined to be one-third natural gas, one-third coal, and one-third nuclear energy, but that mix was never achieved due to the problems with opposition to nuclear power plants. Zon, who was the director of the Nucon engineering firm for a number of years, which specializes in nuclear energy: "If we were to decide tomorrow to build new nuclear power plants, then in my opinion you would have to regard coal gasification differently, because nuclear energy remains cleaner and cheaper. Three fuels with one-third each. That should remain the goal, that is preferable in terms of the environment and price and also in terms of fuel availability."

The assortment of fuels used right now is quite different. Last year, 57 percent of the electricity produced in the Netherlands was generated with natural gas, 37 percent with coal, and 6 percent with uranium. In order to maintain the share of coal—a relatively cheap and widely available fuel—at that level, coal gasification is essential as one of the techniques for cleaner burning. The coal is combined with pure oxygen in a gasifier at a temperature of 1,500 degrees Celsius and a pressure of 30 atmospheres. The coal gas product is then cooled, purified, and subjected to "deep desulfurization," Zon explains, through which the discharge of sulfur dioxide (SO<sub>2</sub>) is sharply reduced. The pure sulfur residue can be easily sold on the domestic market, because the Netherlands currently still imports sulfur.

By diluting the coal gas, the content of nitrogen oxides (NOx) is sharply reduced. Purification (with water) of the gas ensures a very limited discharge of matter from the power plant. The water is purified again and evaporated, which leaves salts as residue. Coal gasification has another environmental advantage: The greenhouse gas CO<sub>2</sub> can be captured easily and cheaply before combustion, although that has a negative effect on efficiency. This is not yet being done in Buggenum, but it can be considered for new, larger power plants.

Over the next two years, Demkolec will test seven types of coal of various composition in the power plant and based on that draw up a "blueprint" for new gasification plants. In the third year, "Buggenum" will work with the SEP's National Efficiency Program, the goal being to show that the availability of the power plant is greater than 70 percent. There are currently 120 people working at the plant on day-to-day operations, plus another 35 experts, including a number of people from Shell and KEMA [Arnem Institute for the Testing of Electrical Engineering Equipment], for testing, the demonstration program, and evaluation.

"Shell has worked for 15 years on the total course of this technology," says Zon. "But the potential for large-scale application of this clean technology has increased sharply over the past five years in particular, so that we can now say confidently that it is becoming affordable

and competitive for the Netherlands, which together with Germany has the strictest environmental regulations in the world."

#### **Sweden: Improved Rotor Blade Improves Wind Energy Yield**

94WS0026B Stockholm NY TEKNIK in Swedish  
9 Sep 93 p 7

[Article by Staffan Dahllof: "Swedish Aeronautics Sets Danish Wind Power Spinning"—first paragraph is NY TEKNIK introduction]

[Text] Windpower plants can capture 20-30 percent more energy with a new type of rotor blade profile. The new long blade was developed in a cooperative effort between a Danish manufacturer and Swedish aerodynamics experts.

Airplane wings have long served as a model for windpower plants' rotor blades.

But a windpower plant's rotor blades are exposed to a large variation in the wind's angle of attack.

"The rotor blades should preferably have a broader spectrum of optimum efficiency than airplane wings," said development chief Peter Grabau of LM Glasfiber, the biggest supplier of wind turbine blades in the world.

These ideas were also found at Sweden's FFA, the Aeronautical Research Institute, in Ulvsunda outside Stockholm.

#### **Sharper Leading Edge**

When the FFA was asked to design a new rotor blade profile the result was a sharper leading edge than before. The blade has lower lift capacity but better performance before it stalls.

Stall means that above a certain speed the wind "loses its grip" on the rotor blade. With increasing wind the wind's angle of attack increases so that finally the air escapes from the suction side of the profile. In an airplane this means that lift ceases. In a windpower plant it means that the rotor blade checks the wind instead of being driven around by it.

#### **Reduced Maximum Output**

The wing for LM Glasfiber was given a triangular profile which makes it stall at a lower wind speed than before. The power plant's maximum output may be reduced which, somewhat paradoxically, is an advantage. Generators and gear boxes do not have to be dimensioned for great wind speeds.

"One can simply capture more energy from the wind in the wind area that lies below the generator's maximum output," said Anders Bjorck of FFA.

This is done by increasing the length of the blade.

To fine-tune stall properties parts of the blade have been given a triangular profile, a so-called stall-strip.

#### **Longer Wings**

With a well-defined stall LM Glasfiber can build longer wings for existing power plants or hold down dimensions on generators for new plants and still get greater yield.

"Larger wings mean that energy production is increased by 20-30 percent," said Peter Grabau of LM Glasfiber.

The FFA's work for the Danish rotor blade manufacturer could benefit Swedish wind power indirectly. The FFA also cooperates with Nordic Windpower (AF Industri teknik and Hagglunds) which built a 400 kW experimental power plant at Lysekil.

#### **Useful for Others**

"The coordinates for LM Glasfiber's wings belong to them, of course, but our increasing knowledge of wing design is something that other clients can also benefit from," said Anders Bjorck of FFA.

#### **Swedish Method to Decontaminate Radioactive Steam Generators Tested**

94WS0026C Stockholm NY TEKNIK in Swedish  
2 Sep 93 p 15

[Article by Lars Eriksson: "Radioactive Scrap Reclaimed With New Swedish Method"—first two paragraphs are NY TEKNIK introduction]

[Text] In the fall Framatome, the French nuclear technology firm, will test a new Swedish method to clean and recycle radioactive steam generators from nuclear power plants.

The method has already been tested on steam generators from the closed nuclear reactor in Agesta outside Stockholm.

The method for cleaning and recycling steam generators was developed by Sweden's Studsvik RadWaste. The Swedish State Power Board, a number of Japanese companies via Mitsubishi, the French power company EDF and the French nuclear technology firm Framatome have supported the development.

Framatome has acquired a license to use the method in the French market. The method will now be tested on a replaced steam generator from the nuclear power plant in Dampierre. If all goes well, there are more steam generators to take care of. France has the highest concentration of nuclear power in Europe.

"This method has two advantages. For one thing we recover valuable metals that can be reused and for another we reduce the volume of radioactive waste," said Olof Andersson, president of Studsvik RadWaste.



Steam generators consist of a very extensive pipe system. The total tube length in an average steam generator is approximately nine miles. It is in the tubes that most of the radioactivity is located.

The tubes are rinsed with a liquid called SODP (Strong Ozone Decontamination Process). It consists of ozone dissolved in nitric acid with cerium nitrate as a catalyst. With the help of the solution about five micrometers of oxide deposit are removed. It is there the radioactivity is located. The process takes 72 hours.

"This type of liquid is sometimes used for cleaning inside reactors. But few people believed in our idea that it could be used to reclaim steam generators," Andersson said.

#### Metals Separated

After it is cleaned the steam generator is melted down and the various metals are separated.

The method has been successfully tested on two steam generators from the closed nuclear power plant in Agesta. The radioactivity in the generators fell from 10,000 bequerels per gram to at best 1 bequerel per gram as a result of the process.

It is somewhat unclear which maximum value applies for a free classification of radioactive material. At present it is 1 bequerel per gram in Sweden, according to the SSI [National Institute of Radiation Protection] standard, but international discussions are under way on this.

The solvent contains most of the radioactivity after processing. The volume is reduced by evaporating the solution ("boiling it down") and encasing it in cement. This waste residue is then shipped for final storage in the storage facility for low- and medium-active waste, SFR in Forsmark.

#### Much Larger

Three steam generators were replaced in reactor 2 at the Ringhals plant several years ago. Studsvik RadWaste and the Ringhals management are currently discussing whether to use the new method on them.

The Ringhals steam generators are considerably larger than the Agesta generators; 300 tons apiece compared with 25 tons. The volume is 17 times greater.

The radioactivity is 10 times higher. The reason is that the Agesta generators have cooled down for about 20 years. The reactor was in operation from 1964 to 1974.

After a Ringhals steam generator is processed there will be 50 tons of nickel and chromium and 200 tons of iron left that can be recycled. The iron can be used for manufacturing concrete reinforcement rods and radiators, among other things. The nickel and chromium that is recovered can be used for manufacturing new steam generators.

That leaves 22 cubic meters of encased radioactive solution, four cubic meters of slag from the smelting process and 15 cubic meters of massive steel (a tube plate that is considered hard to clean).

Melting down radioactive material is nothing new in itself. In the last 10 years around 1,300 tons of radioactive steel from various reactor components and tools have been melted down at Studsvik. Some 200 tons of material has been classified as radiation-free. The remaining 1,100 tons are being stored at Studsvik for final disposal later.

#### Around 150 Replacements

In the next 10 years around 150 steam generators will need to be replaced worldwide. So Studsvik RadWaste, which holds the world patent, hopes that this method will give them a lot of good business in the future.

#### Low Temperature Processes Used in Recycling

94WS0052A Duesseldorf VDI NACHRICHTEN  
in German 1 Oct 93 p 30

[Article by Rainer Antkowiak: "Plastic Waste Frozen in Hydrocarbon Bath; Recycled Material That Comes From Deep Freeze; Individual Polymers Can Be Separated From One Another at 160°C, Corresponding to Their Brittleness"]

[Text] Dortmund, VDI-N, 1 Oct—Clean separation of plastics from other materials and also the separation of individual polymers from one another is an essential prerequisite for the material recycling of plastic waste. A simple and, moreover, inexpensive method has now been developed at the Dortmund Institute of Hygiene.

"I might well imagine that Germany's dual system will soon not just cost money, but even yield profits." With this rather unusual prognosis, Prof. Harry Rosin, the head of the Dortmund Institute of Hygiene, summed up the advantages of a new process for recycling plastics, electronic scrap, and composite packaging materials. The trick to turning "Gelbe Tonnen" [recyclable] waste into recyclable secondary raw materials that are nearly completely sorted into categories is supposed to be: deep freezing to -160°C.

The "Dortmund mixture," consisting of gaseous hydrocarbons and which Rosin has already successfully recommended as a refrigerant free of chlorine and fluorine for refrigerators, is also to be put to use in the form of a similar compound for the treatment of waste. Propane, ethane, and methane take care of the removal of heat—even from a container filled with plastic waste.

The characteristics of the materials are known: Propane liquefies at -42°C, ethane at -88°C, and methane at -161.4°C. Each of these materials—this is the principle the process is based on—vaporizes in separate cycles, extracts heat from the surrounding area, and is reliquefied. In the process, the liquefier of the lower degree of

cold is cooled by the vaporizer of the higher degree of cold until a temperature of  $-160^{\circ}\text{C}$  is reached.

Rosin is convinced that at this temperature any plastic, even unmanageable teflon, becomes brittle, like thin glass. The temperature at which the most commonly used plastics become glasslike is about  $-110^{\circ}\text{C}$ . The various materials become brittle at different temperatures, which causes composite materials to fall apart or break up during the cooling process. Metals in electronic scrap would almost break away from the plastic by themselves because of the different expansion coefficients alone.

In any case, it is anticipated that a simpler way of crushing the material that consumes less energy will be produced by making it brittle. By means of which separation techniques the frozen plastic mixture can be processed is yet to be studied. According to Rosin, sieves, winnowers, and also flotation techniques are currently being tested for their suitability.

Rosin places particular importance on the great cost effectiveness of his process. Hans-Friedrich Hinrichs, the head of the Office for Communal Consultation on Technology in Oberhausen, estimated operating costs at 18 pfennig per kilogram—with reference to a plant that processes five tons of plastic waste an hour and 40,000 tons [as published] a year. And this is not taking into account the proceeds from sales of separated raw materials. Rosin: "This in comparison with the 50-85 pfennig required at the present time by the dual system."

Waste incineration would also benefit from this process. Namely, if the plastic waste is burned as powder, a higher calorific value is obtained than is with the incineration of large pieces.

The deep freeze process has its limits if a plastic is, for example, mixed with fire retardants—like computer housing units. According to Rosin, they are at present engaging in intensive discussions with superregional waste disposal agencies.

## FACTORY AUTOMATION, ROBOTICS

### France: Bull, Sextant Achieve Cost Cuts via Concurrent Engineering

BR0401094194 Paris *ELECTRONIQUE INTERNATIONAL* HEBDO in French 9 Dec 93 p 30

[Article signed L.M.: "Cheaper and Faster Production Through Communications"]

[Text] Concurrent engineering supported by a technical data management [TDM] system reduces expenditure and shortens "time-to-market." Two leading electronics firms, Bull and Sextant Avionique, bear witness to its advantages.

Today, most industrial strategy advisers recommend that firms implement concurrent engineering. This is

probably why there were so many TDM systems at the Productique 93 show, which was held from 22 to 26 November at Paris-Nord Villepinte. This software, supplied by Bull, IBM, Digital, and Win Technology, allows the various sections of a company (design, methods, production, sales) to communicate in real time and thus to be able to work in parallel, which is the basis of concurrent engineering. "TDM enables all those involved in the production process to ratify each new stage of a project. The result is that requests for technical modifications, particularly those from the production department (which cost from 100 to 100,000 times more than in the development phase) are far less numerous. The product therefore costs less and also comes onto the market faster," explained Francois Uiff of Sherpa, a company specializing in TDM, at a conference on the subject at Productique 93. Bull, which both supplies a TDM product (called Bull PDM) and uses such a product, estimates that the cost saving can be up to 50 percent and that time-to-market can be reduced by 75 percent. According to Sextant Avionique, which has also acquired a TDM system, improved traceability is another advantage of these systems: "To reduce our costs, we try, in moving from one application to another, to reuse modules, and TDM makes this easier as it allows us to store the entire history of each module," explained the company's representative. Although those present acknowledged that considerable investment is required and that implementation takes time because TDM involves all divisions of the company, they all asserted that there is a rapid return on the investment. "After around one year," they claim.

### United Kingdom: Rapid Prototyping Consortium Established

BR2912125693 Amsterdam *COMPUTABLE* in Dutch 10 Dec 93 p 3

[Article signed MU: "Consortium for Rapid Application Development"]

[Text] Amsterdam—A consortium has been formed to standardize methods for rapid application development, starting in the United Kingdom, but with the aim of expanding to worldwide operation. The consortium, Dynamic Systems Development Methods (DSDM), wants to make the most of the advantages offered by this method of systems development. The members of the consortium include Software AG, Sapiens, Oracle, Logica, and Cognos. The British firm Butler Group is coordinating its efforts. The advantages of rapid application development, according to Butler, are shorter construction time, lower costs, and improved quality. DSDM is based on interactive prototyping with input from the end user. Prototyping means building a demonstration model to test whether the application meets the required standards. The actual application is then only constructed at a later stage.

### Users Too

In addition to the members listed above, companies such as Information Builders, McDonnell Douglas, Data Sciences, and Knowledgeware also form part of the consortium. Furthermore, Butler Group expects the number of interested suppliers to expand rapidly. "Software manufacturers, consultancies, and major user organizations are showing an interest. It looks as if DSDM will radically change the method of application development," says Peter Constable of Butler.

According to the firm, companies are expressing growing dissatisfaction with traditional development methods. "Companies deserve better. Using old methods with the latest technologies is like putting a diesel engine in a Formula-1 racing car."

The first meeting of the new consortium is planned for January next year. Butler expects approximately 30 suppliers to attend.

### Italy: Robots Used in Hospitals

MI1612133593 Turin *MEDIA DUEMILA* in Italian  
Nov 93 pp 74-77

[Article by Giorgio Riviaccio: "And Now Robots in White Overalls"]

[Excerpts] [passage omitted]

### The Robot Surgeon Is in Italy Too

The United States does not have exclusive rights in the field of robot surgeons. Italy, a country with a great tradition both in medicine and automation, will also have its automaton in white overalls within a year. The experimental use of a robot during surgical operations will start in 1994 at the Rizzoli Orthopedic Institute in Bologna. The experiments will be conducted by Maurilio Marcacci who, together with Prof. Piergiorgio Marchetti, director of the laboratory of biomechanics, and in collaboration with the CNR (National Research Council) and the University of Genoa, has been working on the orthopedic robot project for some years. The Italian experts have asked the advice of ISS of Sacramento on how to perfect the system.

Marcacci explained: "The robot will essentially consist of a mechanical arm that has a number of joints, able to move itself in space, at the end of which there is an instrument (a cutter, a drill or something else) that can be given prior instructions for its movements, based on precise data resulting from examinations such as a CAT (computerized axial tomography) scan or NMR (nuclear magnetic resonance). It will be possible to execute extremely precise repetitive movements using the arm, and these will be better than a surgeon could do."

Researchers at Rizzoli think that the possible applications of an orthopedic robot include surgery of the knee and spine.

### 'Virtual Surgery' at Pisa and at Boston

The orthopedic field is already restrictive for the robot in white overalls. New and promising horizons have already opened up with the marriage between robotics and virtual reality. Digitalizing the images of a patient's organ, something that has been made possible by the diffusion of diagnostic instruments such as the CAT, RMN, and PET [positron emission tomography], seems to have been done to link together and form something that can interpret the data and then intervene on the patient with millimetric precision, that is, a robot.

At Pisa university, researchers from the Santa Chiara Hospital radiology institute, together with researchers from Hewlett-Packard, one of whom is the American Irwin Sobel one of the fathers of computerized graphics, have created the first Italian virtual reality system applied to neurological diagnosis, medicine, and to the preparation of surgical operations. The radiologist Davide Caramella, one of the researchers working on the project, explained that: "The system acquires data from diagnostic instruments like the TAC and magnetic resonance. These supply two-dimensional images that correspond to many very fine 'strata', or 'slices' of an organ, such as the brain. The computer uses special software to reconstruct a three-dimensional virtual image from this information. The different tissues of the brain are then highlighted using false colors. Finally a pair of stereoscopic glasses that look like an underwater mask recreate the effect of depth for the person wearing them, thanks to which the image literally seems to come out of the screen and invade the room."

Former systems for the visualization of medical images, such as those based on videodisks or multimedia computers, suddenly become out of date because the data they contain cannot be changed and refers to a typical patient, comparable to that shown in the anatomical plates of a text book. On the other hand, using the system developed at Pisa, the neurologist, or the surgeon, finds himself in front of a faithful representation of the brain structure of that particular patient. In this way they can carry out a virtual surgical operation, identical in every part to that which they must then face in reality. For example they can study the best course for an instrument to reach the mass of a tumor without damaging the healthy structures that surround it and they can find out whether they will meet other risky situations during the operation such as an aneurysm that could burst. [passage omitted]

Finally, the potential of virtual reality in neurosurgery is the central point of research being carried out by Cesare Giorgi of the Carlo Besta Neurological Institute in Milan, as part of the CNR targeted robotics project.

### How Much Electronics for Remote Surgery

But virtual reality is not only images. It also makes it possible to intervene on the electronic environment



created by the computer and modify it using an "electronic glove," called a "dataglove," that directly translates the movements of the hand, wrist, and individual fingers, into instructions for the computer.

The "dataglove," developed by Jaron Lanier of the American company VPL Research, is made of photo transistors and sensors that capture every movement made by the hand, while tiny gyroscopes keep record of the movements of the complete hand in space. The "dataglove" was also baptized in the medical surgery field, when on 2 December last year the first remote surgical operation was performed between the Milan Polytechnic and the Umberto I General Hospital in Rome.

Wearing a "dataglove," Prof. Alberto Rovetta of Milan commanded a robot installed in Rome which performed an operation on a model via cable. The movements of Rovetta's hand, which moved in the air, were transferred with the greatest accuracy to the arm of the robot. With respect to former remote control techniques for robot systems, "dataglove" avoids having to learn the commands and techniques of manipulation. The user only has to perform the natural movements that he would perform on a real patient.

This Italian "first" opens up a horizon that has no limitations and makes it possible to operate on patients that are hundreds or thousands of kilometers away, perhaps in areas where it is not possible to have the specialized assistance necessary for a serious case.

This was quickly confirmed on 7 July by another exceptional experiment conducted by Italy and the United States. For the first time in the world a surgeon, Licineo Angelini of La Sapienza University in Rome, operated via satellite from California on an animal organ in the Milan Polytechnic. The operation was made possible by a robot manipulator, commanded by Angelini and connected to an identical piece of equipment that operated on the sick organ.

The "patient" was a simulator model of the human body in which the liver of a pig and a synthetic gall-bladder had been inserted. The Italian part of the experiment was once again coordinated by Alberto Rovetta of the Milan Polytechnic, who drew from the experience of the American jet propulsion laboratory of Pasadena, the NASA research institute where the "space robots" that explored the planets of the solar system were born.

Angelini had a robot in front of him and an ecographic monitor that sent back the images of the "patient" in Milan. The surgeon commanded the robot, that then transmitted the instructions to its correspondent in Milan, ordering it to make a stitch after having localized the exact point on the model by means of the ecographic scanner images. Then the robot was ordered to make two incisions.

The experiment was part of the CIAO [Collaboration, Intervention and Help in Hospitals] program that plans for remote surgical operations to be performed by robots.

#### **The Robot That Reconstructs the Organism in Milan**

However, in the hospital of the year 2000, the robot will not only take over in the operating theater. Other types of automations will work in laboratories to reconstruct, with the maximum accuracy, bones and other "inserts" of human tissue that have been destroyed as a result of accidents or destructive surgery.

The prototype computer-robotic reconstruction system, which is unique in Europe at present, has once again been perfected in Milan by the group of Luigi Donati, director of the Statale University plastic surgery institute, and has been built at Niguarda hospital.

It is called MIRUS-Lab (Management of Imaging and Robot Utilization in Surgery) and once again it results from the possibility of digitizing any element of the organism using diagnostic image techniques. The computer, integrating the data coming from these instruments, reconstructs an "electronic twin" of the patient on the screen. Then using techniques similar to those of the CAD-CAM [computer-aided design - computer-aided manufacturing] used in industry for computer design, the system examines the area to be reconstructed and designs the anatomical parts that are missing. Finally it transfers the design to a robot that builds the "bioinserts" to be put into the patient, using numerically controlled fabrication techniques similar to those used by advanced mechanical industries.

Finally, the MIRUS-Lab is also able to help the surgeon to choose, and optimize, different materials with respect to the biological and mechanical characteristics of the parts to be replaced.

Thanks to this system it is therefore possible to carry out reconstructive surgery, by having the exact prosthesis to be inserted in the patient, in bone or other tissue, available before the operation, and eventually to carry out a first simulation of the operation on a computer, to see if the insert has been made correctly and if it adapts exactly to the organism of the patient. In fact, the reconstruction of anatomical parts has hitherto been performed directly in the operating theater and for obvious reasons the surgeon had to prepare these parts extremely quickly. [passage omitted]

**Machine-Tool Innovations Presented in Hannover**  
94WS0079A Paris L'USINE NOUVELLE in French  
30 Sep 93 pp 60-61

[Article by Daniel Chabbert and Michel Vilnat: "Machine Tool Industry Still Innovating"; introductory paragraph in boldface as published]

[Text] The World Machine Tool Fair [EMO] has lived up to its reputation as a technological showcase. But the industry is in crisis. Mergers and takeovers of firms are increasing.

Linear spindle driving motors, very high-speed steel machining, and the integration of PC's [personal computers] into numerical control were all part of the 10th EMO, which was held in Hannover in mid-September and which lived up to its reputation as an international technological showcase. But economic conditions are not conducive to optimism, especially among European manufacturers.

A sign of the times: CECIMO [European Cooperation Committee for Machine Tool Industries], the organization representing all European machine tool manufacturers associations, has just presented the European Commission with a document—the first ever—in which it makes proposals for maintaining the competitiveness of its firms in the world market. The crisis is affecting German manufacturers in particular. They are facing a wave of mergers and takeovers that has been growing steadily stronger in recent months.

Following the announcement of Maho's merger with Deckel, there is already talk of their joining the Gilde-meister group, a company that has been sharing its worldwide marketing network with Deckel since the beginning of the year. Another German merger, that between Traub and Hermle, is being limited solely to the marketing network for the time being. In the field of large machines, the Doerries-Scharmann group is becoming the world leader by acquiring several moribund companies around the world in a short period of time (Wohlenberg, Skoda Machine Tools, Schiess, and the RD&D). Kennametal, the number one American maker of cutting tools, acquired 81 percent of the Hertel Company's capital as recently as last August.

But that very lively situation is not preventing some manufacturers—and not necessarily the biggest—from continuing to innovate. Among the most outstanding innovations presented at the EMO, those involving numerical control will certainly have an important impact in all machine tool sectors. Most of the major manufacturers have sought to integrate PC's into their numerical control systems. One example is the French manufacturer Num, whose PCNC, the fruit of a union between a PC and a CNC [computerized numerical control] system, will have applications in turning, milling, and so on. The marriage of those two technologies opens up numerical control to the OS2/2.1 multi-tasking system. It improves versatility considerably. Numerical control directs the work process as well as the path of the automatic mechanisms. In the meantime, the Intel 486 microprocessor supervises the man-machine interface. For example, it manages the programs and tools, helps with maintenance, and makes it possible to use advanced CAD/CAM [computer-aided design and manufacturing] programming languages. "A detail of

interest to future customers is the fact that this introduction of the PC into numerical control will have a very slight effect on prices," says Jean-Luc Gely, Num's marketing and product director. This new development is not restricted to Num. GE Fanuc is offering a similar improvement in its CNC-16, which has been renamed 16M in honor of the occasion. Like the French product, the 16M uses an Intel processor.

#### Operation Display

For its part, Grundig Electronics is also unveiling a new generation CNC using three 32-bit processors with Risc architecture. Christened the CNC EPL Turn Plus and intended for turning operations, it also uses PC-type Windows programming. As an example, it can take charge of the entire machining process on a two-spindle lathe without the operator's having to concern himself with transferring the workpiece from one spindle to another. It is also used on the Electro Pilot Turn Plus, a lathe that makes it easier to program the numerical control system. The workpiece is first machined in the conventional manner using electronic levers, and the CN uses that to automatically set up the corresponding program.

For its part, Siemens is exploring an original path: multimedia using its CNC Sinumerik 840C. With this system, the operator can observe the operation continually on all or part of the screen. Doerries-Scharmann is offering the same arrangement on one of its Contumat vertical lathes.

Long considered unattainable, the high-speed machining of hard materials is beginning to become an industrial reality. "Mass-produced" machines of that kind are now being offered to users. With its Heynumill 2500-GS portal milling machine, Germany's Heyligenstaedt is representative of that trend. For semifinishing operations, its machine uses a 20-kW, 10,000-rpm spindle with a feed speed as high as 15 meters per minute. For finishing operations, it is equipped with a high-frequency (25,000 rpm) 16-kW head.

Naturally, the Germans are not the only ones to have developed high-speed industrial machines. After several years of research, Forest Line is offering two lines of portal milling machines, both equipped with a 25-kW spindle running at up to 30,000 rpm. Their main applications are in the finishing of molds or pressing dies. An expert at Forest Line says: "Compared to a conventional machining cycle, we have reduced the total fabricating time by half and even two-thirds in the case of complex workpieces." That gain is due partly to faster cutting speed and partly to improvements in the geometry and surface condition that eliminate the need for manual polishing. High-speed machining is not limited to large workpieces. For working with small items, Switzerland's Mikron has designed its line of HSM machines. They use the architecture of portal milling machines and are equipped with high-speed spindles capable of running at up to 75,000 rpm in finishing operations.

The machining of hard materials, steel in particular, is the object of research by manufacturers. One objective is to eliminate the grinding phases by machining with the CBN [cubic boron nitride] tool. With that in mind, the Hembrug firm unveiled its Slantbed-Mikroturn 100-CNC, a highly accurate lathe capable of producing workpieces with a tolerance better than 1 micron and a surface roughness (Ra) of less than one-tenth of a micron in hard steels of 60 to 62 Hv. That performance is achieved by the use in particular of a Num 1060 numerical control system connected to a measuring device permitting a resolution of 0.01 micron. A spindle mounted on a gas bearing and hydrostatic guides complete the picture. Even more original is Kugler's latest offering, the Hydro-air HP-100, which is also outstanding in achieving tolerances down to one-tenth of a micron and even less. Movement is achieved using linear motors. Guiding is handled through the harmonious combination of a hydrostatic journal bearing that absorbs stresses and a gas bearing that provides high-speed guidance.

Innovations also exist in other areas besides that of machining with the aid of cutting tools. Charmilles Technologies unveiled a new concept in the field of electrical discharge machining [EDM]: spark machining by milling. This technique combines EDM for forming holes with milling. It uses a system of traveling standard cylindrical electrodes to machine the workpiece layer by layer. It is no longer necessary to cut graphite electrodes in complex forms. "The more complex the workpiece, the larger the gain in productivity," says Jean Martin, marketing director for Charmilles Technologies.

New products for sheet metal work also seem to be synonymous with productivity. In the case of Finn-Power, that productivity is the result of the impact capacities of its new generation of nibbling and punching machine, which achieves and exceeds 1,000 cps per minute in nibbling operations and over 500 cps per minute in punching operations. For its part, Mazak Nissho Iwai is focusing on the feed system in its laser cutting tables (now with stationary optics). The system consists of a fork whose teeth, spaced 50 mm apart, pass between the notches on the table, making it possible to unload workpieces automatically if they are at least 100 mm long. "Stopping time is comparable to that with a table using mobile optics and equipped with a palletization system," emphasizes Xavier Rouchaud, marketing director for Europe.

### Increased Productivity

To increase the productivity of bending presses, Amada is offering a handling robot that can replace a night crew. Suitable for small pieces (from 15 mm to 350 mm), this robot on rollers can be placed in front of any kind of press. It is a solution that can be considered when retrofitting a machine.

For its part, Trumpf is presenting a punching/bending unit combining a Trumatic 500 Rotation punching machine with a "panneauteuse" manufactured by the Ras Company. This unit's high degree of automation and flexibility predestine it for the manufacture of workpieces in small and medium-size runs.

The Bokoe Company, a German PME [small or medium-size business] specializing in the manufacture of flow turning machines, is offering a technology for generating boring without machining—a technology developed in cooperation with Chemnitz University. It consists of boring steel bars that are being rotated as though on a lathe. Two types of tools are necessary: The first, in cylindrical form, presses against the forward surface of the bar while the second, consisting of three tangentially placed knurling wheels, gradually crushes the periphery of the bar. The operation is comparable to turning on a lathe, but without the removal of cuttings. It produces a hollow form matching the geometry of the first tool. Smooth or grooved holes can be produced in this manner in a single pass. Moreover, the surfaces of the bores are similar to those obtained by grinding.

### Machining Centers At Affordable Prices

Not everyone is looking for sophistication. The American giant Cincinnati, for example, is aiming at the market for "cheap" machining centers with its new Arrow line. Despite a price below 400,000 francs, these machines possess very interesting characteristics: a displacement speed of 12 meters per minute, accuracy of plus or minus 4 microns, a spindle speed of up to 6,000 rpm, and a 21-tool changer. This machining center is equipped with a specific but nevertheless high-performance numerical control system. The American firm is not the only one exploring this niche in the market: Switzerland's Mikron unveiled its new VCE line, which has very similar architecture.



**Brazil: Russian Technology Considered for Upgrading Brazilian Power Lines**

94WS0092A Sao Paulo GAZETA MERCANTIL  
in Portuguese 29 Oct 93 p 12

[Article by Antonio Guetierrez: "CHESF Considers Russian Technology for Increasing Power by Adding Cables"]

[Text] Recife—The Sao Francisco Hydroelectric Company (CHESF) is considering the adoption of a new transmission line technology that will enable it to increase power without having to replace substation equipment.

The system was developed in Russia and is being transferred to the Eletrobras system under an agreement signed in 1992 between that Brazilian government-owned firm and the Leningrad Polytechnic Institute. The cost of this new method is limited to the salary of Russian Prof. Georgiy Podporkin, who has been in Brazil since January to pass on the technical know-how concerned.

The new technology, known as High Natural Power Line (LPNE), is available to all the firms in the Eletrobras system. So far, only Furnas and the CHESF are thinking of introducing the new system. In the West, only Cuba uses this technology, according to Eng. Oswaldo Regis, Jr., of the CHESF Engineering and Construction Department.

LPNE makes it possible to increase the power of a transmission line (which in Brazil uses the three-phase system) by adding more cables in asymmetrical positions to each of those phases. The positions are determined by computer calculations. The asymmetrical system makes it possible to double the natural power on the line by adding a second cable for each phase or to triple the power with a third cable. For example, the power of a 230-kilovolt (kV) line can be increased from 130 megawatts (MW) of natural power to 260 MW (with two conductors per phase) or to 360 MW with three conductors.

Under the traditional system, which is the one currently used by the national electricity grid, power is also increased by adding more cables, but in symmetrical positions. Increasing the number of cables in symmetrical positions does not result in a significant increase in power. On a 230-kV line, for example, adding one more cable increases the natural power from 130 MW to 170 MW, or 30 percent, according to Regis.

"In symmetrical distribution, one conductor always has a higher electric field than another, while in asymmetrical distribution, the conductors have an equalized electric field, resulting in a larger power gain," Regis explains.

He admits that the technology is simple—"a real Columbus' egg"—and that the mathematical computations can be made with a small computer. The CHESF's only concern in adopting the new system on a commercial scale has to do with the possible mechanical effects on the pylons and with the fittings for holding the conductors.

To study those effects, the CHESF will energize a 1.6-km experimental line in Aldeia in the Recife metropolitan area within the next 30 days. The line is currently used for training purposes. "We intend to test the tripling of power on a 230-kV line," the CHESF engineer explains. The firm plans to install the LPNE system on a section of 230-kV commercial transmission line by 1994. That experiment will have the support of electrical equipment firms, which are to furnish the equipment. The cable will be supplied by the CHESF from inventory. "It is a way of reducing the cost of the experiment," says Regis.

Besides a greater increase in power, the LPNE system eliminates the need to invest in new equipment or substations. "The intention is to eliminate or postpone investments in new lines with higher voltages," Engineer Regis points out. "Increasing the voltage level by replacing equipment carries a higher cost." The cost of installing a 230-kV substation currently comes to around \$7 million, while a 500-kV substation costs approximately \$15 million.

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